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Statewide Information Technology Planning Project

Massachusetts Board of Higher Education

February 1998

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A Vision for Educational Technology in the Commonwealth

- **Imagine** students connecting to an interactive computer network where faculty, mentors, researchers, professionals, and other students share ideas and experiences that enhance the learning process. In-person faculty instruction is supplemented by Web-based course materials and on-line discussion groups. Outside of class, self-paced multimedia courseware offers a flexible, interactive, and efficient learning environment, where progress is competency based.

- **Imagine** instructional technology resources available to faculty and students of the Commonwealth's public colleges and university that rival those of the most technologically proficient institutions in the country. A virtual digital library comprised of shared data bases is accessible from all campus networks. Technologically advanced instructional classrooms provide crucial training to faculty and students, enabling them to function effectively in their enhanced learning environment. Regional educational technology centers maintain cutting-edge capabilities and support campus-based efforts, while serving as clearinghouses for technology enhanced learning resources developed throughout the system.

- **Imagine** campus administrative effectiveness and efficiency improved through the use of the latest Management Information Systems (MIS) technology. Service delivery is enhanced, and student satisfaction with admissions, financial aid, registration, and other administrative processes is high. Strategic planning and decision making are based on better quality information that is available on a more timely basis.

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To stay competitive in the 21st century, Massachusetts state and community colleges must achieve this vision and take advantage of technological advances in teaching and learning.

The advantages of moving forward in this technological age are widespread, benefiting:

- students on and off campus
- lifelong learners
- faculty
- libraries
- campuses
- the state higher education system
- the Commonwealth

Quality education is increasingly dependent upon information technology. Students learn more and faculty productivity increases. Campus reputations and the entire system are enhanced. The Commonwealth strengthens its role as a national leader in innovative uses of technology, and the workforce gains technologically literate graduates.

Massachusetts must invest and build a foundation for technology enhanced education. The cost of failing to do so is far too great a price for students, campuses, and the Commonwealth to pay.

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Exemplary colleges and universities already have a vision of information technology as a strategic asset and invest in it to enhance their educational services.

- Early adopters of technology, such as the University of Delaware and Carnegie Mellon University have invested in comprehensive network infrastructures to ensure full connectivity for their campuses. This allows them to share educational and administrative services with greater efficiency.
- Statewide digital library programs in Ohio, Virginia, Georgia, and elsewhere are already providing students and faculty with educational reference materials via the World Wide Web. These services expand learning opportunities by creating more points of access to knowledge.
- National Technological University, University of Phoenix, Western Governor's University, California Virtual University, and others are investing in instructional technology to deliver their educational services to students in new ways. The learning experience is also being transformed by the introduction of technologies such as courseware, e-mail discussion groups, and interactive Websites.

At exemplary institutions, information technology is no longer just a luxury. It has become an integral part of the learning process.

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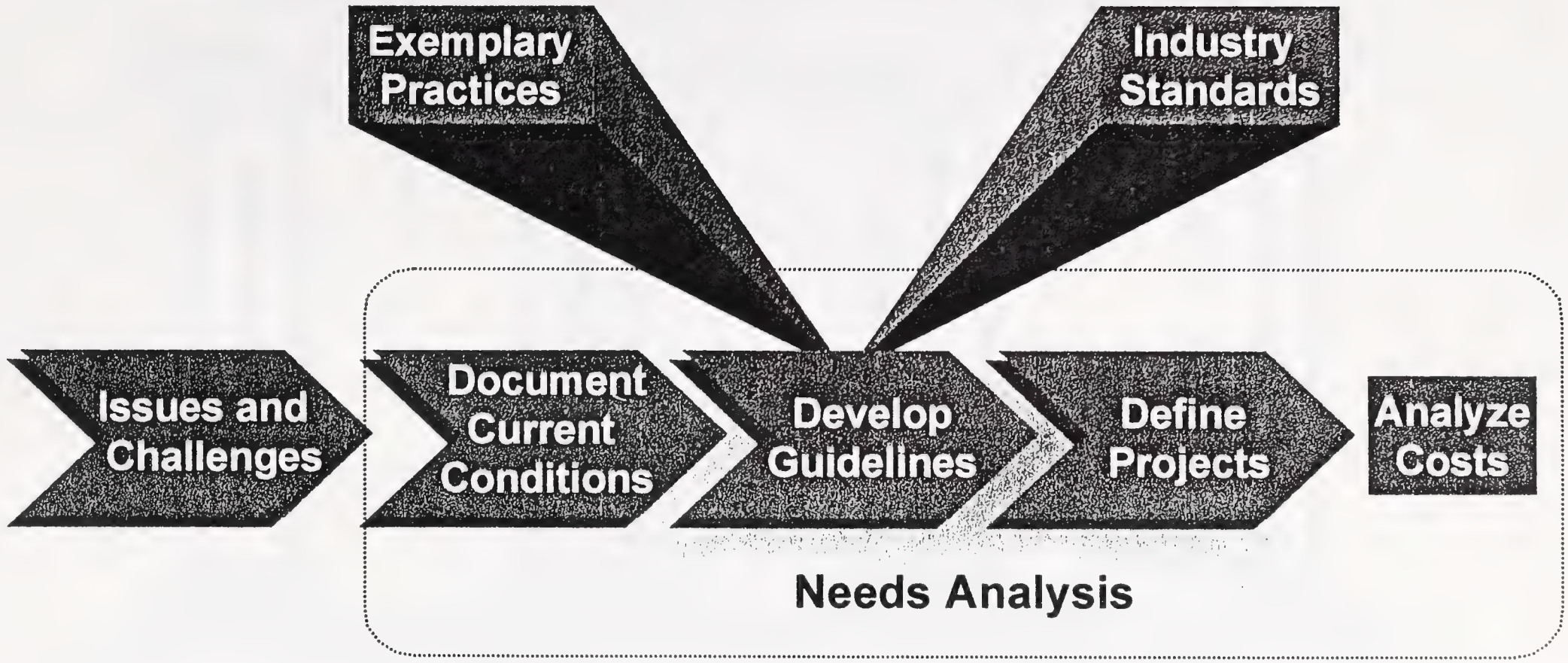
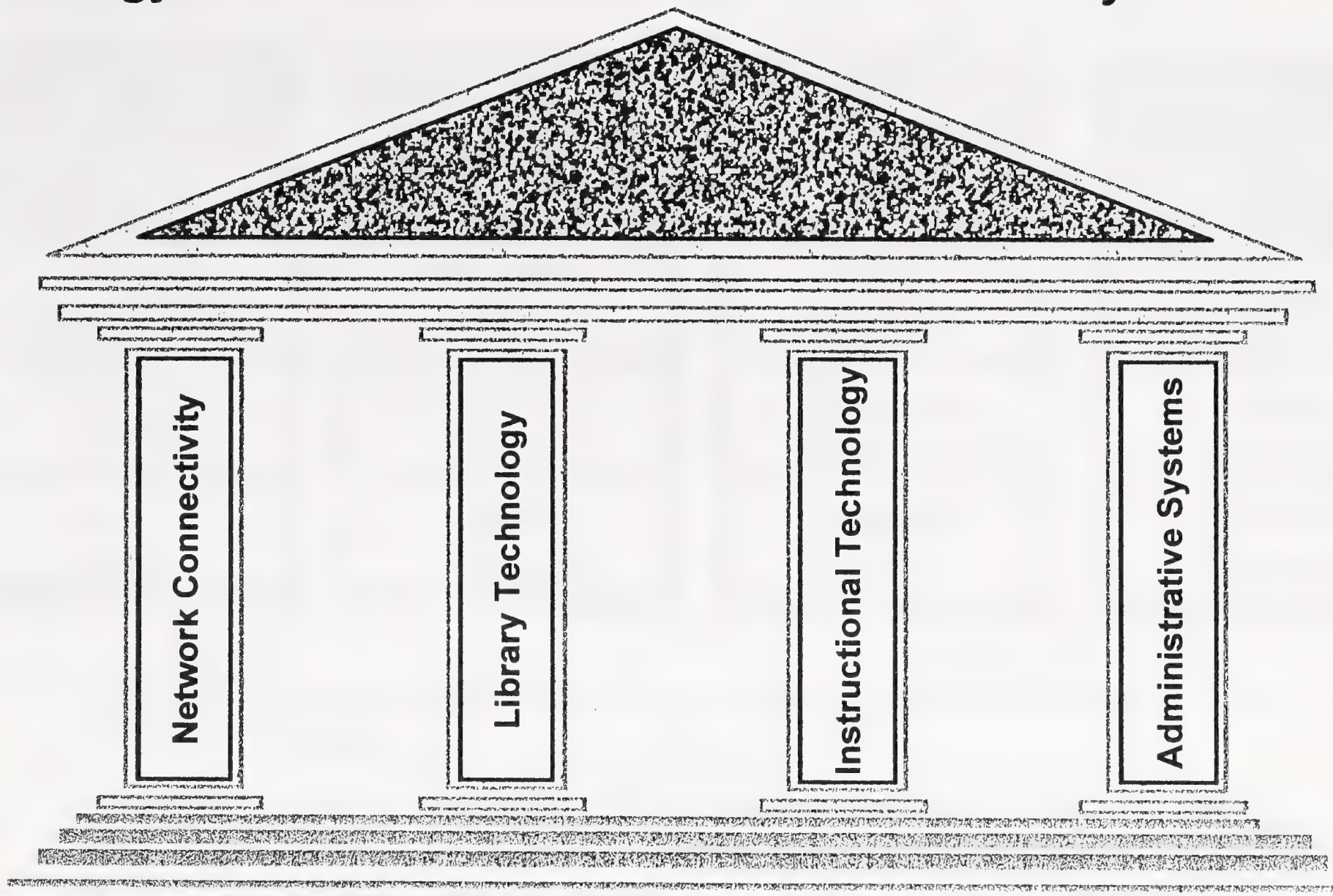
The state and community colleges have conducted a comprehensive planning effort, using a consistent framework for analyzing a broad array of information technology issues and defining the investments needed to achieve their vision.



A survey of all 24 campuses identified four primary information technology issues to focus on over the next three years.



Ensuring technical proficiency in these areas will provide the campuses with crucial information resources to support their educational mission.

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Detailed information was gathered about the four primary issues, and 12 project categories were defined.

Network Connectivity	Library Technology	Instructional Technology	Administrative Systems
Physical Infrastructure	Instructional Classrooms	Course Enhancement	Software Systems
Technical Systems	Library Mgmt. Systems	**Training and Development**	Hardware Platform
Remote Access	**Shared Databases**	**Distance Education**	**Shared Services**

- Bold text indicates collaborative project categories (remote access, etc.) for multiple campuses.
- Remaining project categories (physical infrastructure, etc.) are specific to each campus. However, due to prior investments, campuses do not necessarily have project needs in each category.

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Specific investments by the Commonwealth for campus-based capital projects and collaborative programs are critical.

Campus-based capital projects are intended to strengthen the technological foundations of the colleges.

- These projects generally require a large initial investment that will eventually provide benefits to a broad cross-section of the campus community. Examples of identified projects include campus-wide data network infrastructure, library and administrative information systems, and local instructional technology infrastructure. Ongoing institutional-level investments will be necessary to build upon early Commonwealth support.

Collaborative programs are opportunities for multiple campuses to work together to provide improved services and/or reduced costs.

- Programs that encourage campus cooperation will require both initial capital and ongoing operating expenditures. For example, providing collaborative faculty training and development for instructional technology will require both a physical site and staff to coordinate and conduct the training.

This plan is focused on capital and collaborative needs and does not address specific campus operational IT needs. Issues such as the purchase of desktop computers and local staffing are ongoing campus operating responsibilities beyond the scope of this plan, but must be considered in campus-level technology plans that campuses need to complete by the end of August.

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Detailed analyses were conducted in each of the four areas to determine campus and systemwide needs. Target levels of capabilities were established in each area for campuses to use in assessing their needs. Target levels position campuses to take full advantage of current state of the art educational technologies and to move ahead with future advancements.

- Total estimated needs for capital and annual operating funds to reach target level in each area are:

	One-Time Capital	Annual Operating	3-year Total
• Network Connectivity	$10,521,000	0	10,521,000
• Library Technology	$ 4,480,000	500,000	5,980,000
• Instructional Technology	$ 950,000	1,470,000	5,360,000
• Administrative Systems	$12,398,000	0	12,398,000
TOTALS*	**$28,349,000**	**1,970,000**	**34,259,000**

*All costs in this plan are for specifically defined projects. Campuses will incur additional operating costs for ongoing technology investments such as staffing and desktop computers.

Estimates are based on project investment briefs prepared by the campuses and program cost estimates based on experiences at other institutions. Details are provided in the body of the plan and in the appendices compiled as supporting documentation.

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Issues and Challenges—Network Connectivity

Rapid growth in demands for network capacity for Internet applications, instructional technologies, new administrative systems, online library databases, and other uses are overwhelming current systems.

- To be technologically competitive with exemplary institutions, the campuses will need to install a Physical Infrastructure to all facilities, maintain Technical Systems to operate a high speed data network, and provide Remote Access as demand increases.

- Estimated costs to reach at least target standards on all campuses for the components of network connectivity are:

	One-time Capital	Annual Operating	3-year Total
– Physical Infrastructure (wiring, etc)	$ 4,416,000	0	4,416,000
– Technical Systems (switches, etc)	$ 5,855,000	0	5,855,000
– Collaborative Remote Access	$ 250,000	0	250,000
TOTALS	**$10,512,000**	**0**	**10,521,000**

Network technologies are evolving constantly, necessitating continuous investment in upgrades. Future expenditures on technical systems should be expected as technology advances to the next level.

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Issues and Challenges—Library Technology

Libraries are confronting the challenge of continuing to collect printed materials while addressing the expanding responsibility for accessing digital resources, as well as for providing technology instruction.

- This expanding mandate for libraries will lead to greater needs for funding. The growth of digital resources calls for investments in on-campus Technology Instructional Centers, Library Management Systems, and Shared Databases Online.
- Cost estimates for these systems and resources are:

	One-time Capital	Annual Operating	3-year Total
– Instructional Classroom	$3,011,000	0	3,011,000
– Library Management Systems	$ 899,000	0	899,000
– Digital Microfilm Reader/Printers	$ 570,000	0	570,000
– Shared Databases Online	$ 0	500,000	1,500,000
TOTALS	**$4,480,000**	**500,000**	**5,980,000**

Access to information is being transformed by technology, and there is a growing need for library technology resources to gather and organize, as well as to train users to access the new forms of information.

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Issues and Challenges—Instructional Technology

Growing use of instructional technology by faculty and students is creating new demands for training facilities, materials development centers, and support services.

- To support those developmental efforts, the Board should develop a Courseware Pilot Program, a Courseware Clearinghouse, regional Instructional Technology Centers, and Distance Education collaboration.
- The costs for these investments in instructional technology are estimated to be:

	One-time Capital	Annual Operating	3-year Total
– Instructional Technology Grant Program	$ 0	100,000	300,000
– Courseware Clearinghouse	$ 150,000	70,000	360,000
– Regional Instructional Technology Centers(4)	$ 800,000	800,000	3,200,000
– Collaborative Distance Education	$ 0	500,000	1,500,000
TOTALS	**$ 950,000**	**1,470,000**	**5,360,000**

Instructional technology offers new possibilities to enhance teaching and learning. Successful transition to the new media requires training, technology, and support to prepare students and faculty.

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Issues and Challenges—Administrative Systems

Administrative systems designed in the 1980's are reaching the end of their useful life, facing problems of limited functionality, antiquated hardware and software, and Year 2000 compliance.

- Many of the campuses have administrative systems with some limitations that make it difficult to operate efficiently. System improvements or replacement often requires significant capital investments in hardware, software, and implementation services that many campuses do not have available in their operating budgets. Shared Services among campuses could reduce the costs of implementing and maintaining the systems.
- Costs to upgrade or replace the administrative systems are estimated by the campuses to be:

	One-time Capital	Annual Operating	3-year Total
– Administrative Systems	$12,398,000	0	12,398,000
– Shared Services Opportunities	$ 0	0	0
TOTALS	**$12,398,000**	**0**	**12,398,000**

The costs used for these estimates include hardware, software and implementation services. Annual operating expenditures by campuses for desktop computers, staff support and vendor maintenance are not included.

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Recognizing these issues and challenges, the Technology Steering Committee established the following priorities for action.

1. Network Connectivity

- The network infrastructure must be in place before full educational and administrative benefits of the systems and activities can be achieved.

2. Library Technology

- Since libraries are existing centers of academic activity, investments in library technology can result in immediate benefits to the learning process.

3. Instructional Technology

- In the future, instructional technology is expected to have a significant impact on academia. Investments today will build a foundation for this activity and help faculty and students make the transition from traditional to technology-based teaching and learning.

4. Administrative Systems

- The development of efficient and effective administrative services is an ongoing process. Campuses can use these one-time capital investments to improve systems, but then must use operating funds to keep their new administrative systems current.

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Recommended Next Steps

To reach the target levels for technical proficiency in these areas, the Board of Higher Education should adopt a two-pronged strategy.

- First, make needed capital investments in the four identified areas to build the systems necessary to support improved educational and administrative performance.
  - Like the telephone system, a computer network must be ubiquitous to be of greatest value. The usefulness of the investment in technology grows dramatically as the number of network connections expands, because each new connection provides all users with access to additional information.
- Second, the Board should call on campuses to allocate campus funds to support the implementation and operation of these complex systems and to assess any remaining need for increased operating funds.
  - Studies have shown that more than 75% of technology costs are attributable to training, maintenance, and support activities. These are operating costs that campuses need to allocate to support the new systems. The value of the capital investment will be reduced if the necessary support services are not available on the campuses.
  - While the scope of this study, which focused on capital and collaborative needs, did not assess the need for additional campus operating funds, it is clear that campuses may be struggling to maintain service capabilities. As part of future campus planning efforts, each institution should document its operational staffing needs and discuss what combination of reallocation of existing resources and new funding requests will meet the documented needs.

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Recommended Next Steps

Specifically, it is recommended that the Board complete the following steps:

Seek full release of the $18 million Educational Technology bond.

- Use this money to fund the capital expenditures recommended in this plan. Request funding for the remaining $11 - 12 million needed to support the completion of identified projects not fully funded by existing resources.

Develop a funding strategy for providing enhanced operational support for technology on the campuses.

- Base budgets for the campuses should be evaluated to determine if they are adequate to support the increased costs associated with introducing technology into the learning and administrative processes.

Develop a funding strategy to provide continuing support for multi-campus collaborative opportunities.

- These funds should be used to meet needs for licensing digital library materials, providing instructional technology training and development activities, and encouraging shared administrative services. This could be accomplished using an annually funded, central reserve budget to promote collaboration.

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A Vision for Educational Technology in the Commonwealth

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- **Imagine** instructional technology resources available to faculty and students of the Commonwealth's public colleges and university that rival those of the most technologically proficient institutions in the country. A virtual digital library comprised of shared data bases is accessible from all campus networks. Technologically advanced instructional classrooms provide crucial training to faculty and students, enabling them to function effectively in their enhanced learning environment. Regional educational technology centers maintain cutting-edge capabilities and support campus-based efforts, while serving as clearinghouses for technology enhanced learning resources developed throughout the system.

- **Imagine** campus administrative effectiveness and efficiency improved through the use of the latest Management Information Systems (MIS) technology. Service delivery is enhanced, and student satisfaction with admissions, financial aid, registration, and other administrative processes is high. Strategic planning and decision making are based on better quality information that is available on a more timely basis.

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This plan will help achieve that vision by guiding the investment in technical systems comparable to those found at exemplary institutions throughout the country.

Exemplary colleges and universities view information technology as a strategic asset and invest in it to enhance their educational services.

- Early adopters of technology, such as the University of Delaware and Carnegie Mellon University have invested in comprehensive network infrastructures to ensure full connectivity for their campuses. This allows them to share educational and administrative services with greater efficiency.
- Statewide digital library programs in Ohio, Virginia, Georgia, and elsewhere are already providing students and faculty with educational reference materials via the World Wide Web. These services expand learning opportunities by creating more points of access to knowledge.
- National Technological University, University of Phoenix, Western Governor's University, California Virtual University, and others are investing in instructional technology to deliver their educational services to students in new ways. The on-campus learning experience is also being transformed by the introduction of technologies such as e-mail and interactive Websites.

At exemplary institutions, information technology is no longer just a luxury. It has become an integral part of the learning process.

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Specifically, the plan provides a detailed analysis of the need for investments in campus-based capital projects and collaborative programs necessary to realize the vision.

Campus-based capital projects are intended to strengthen the technological foundations of the colleges.

- These projects generally require a large initial investment that will eventually provide benefits to a broad cross-section of the campus community. Examples of potential projects include campus-wide data network infrastructure, library and administrative information systems, and local instructional technology infrastructure.

Collaborative programs are opportunities for multiple campuses to work together to provide improved services and/or reduced costs.

- Programs that encourage campus cooperation may require both initial capital and ongoing operating expenditures. For example, providing collaborative faculty training and development for instructional technology will require both a physical site and staff to coordinate and conduct the training.

The plan is purposefully focused on capital and collaborative needs and does not address specific campus operational IT needs. Issues such as the provision of desktop computers and local staffing are ongoing campus operating responsibilities, and as such, are not in the scope of this plan.

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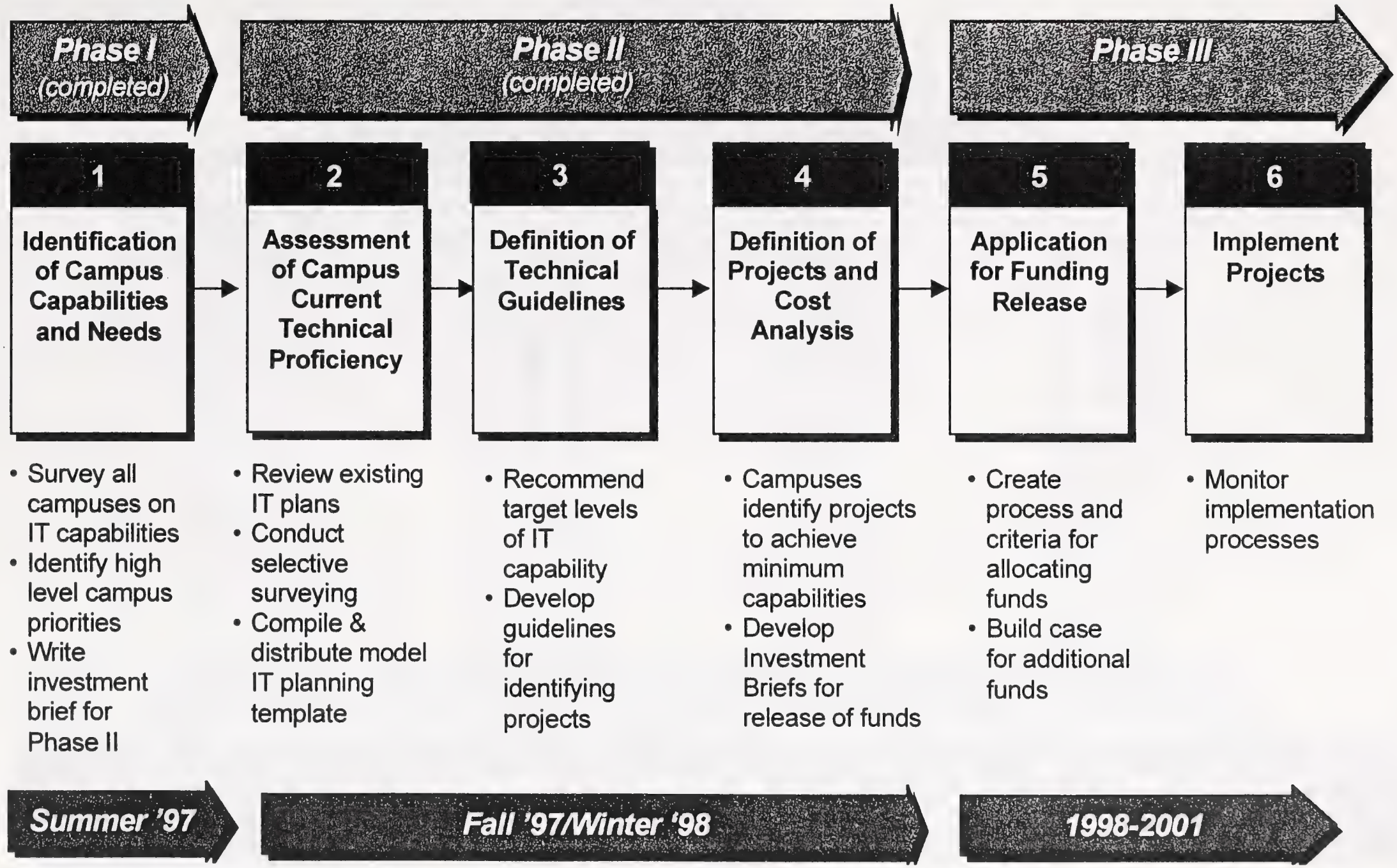
To define the information technology needs, a three phase planning process has been used.


Phase I (completed)
Phase II (completed)
Phase III
1
Identification of Campus Capabilities and Needs
• Survey all campuses on IT capabilities
• Identify high level campus priorities
• Write investment brief for Phase II
2
Assessment of Campus Current Technical Proficiency
• Review existing IT plans
• Conduct selective surveying
• Compile & distribute model IT planning template
3
Definition of Technical Guidelines
• Recommend target levels of IT capability
• Develop guidelines for identifying projects
4
Definition of Projects and Cost Analysis
• Campuses identify projects to achieve minimum capabilities
• Develop Investment Briefs for release of funds
5
Application for Funding Release
• Create process and criteria for allocating funds
• Build case for additional funds
6
Implement Projects
• Monitor implementation processes
Summer '97
Fall '97/Winter '98
1998-2001

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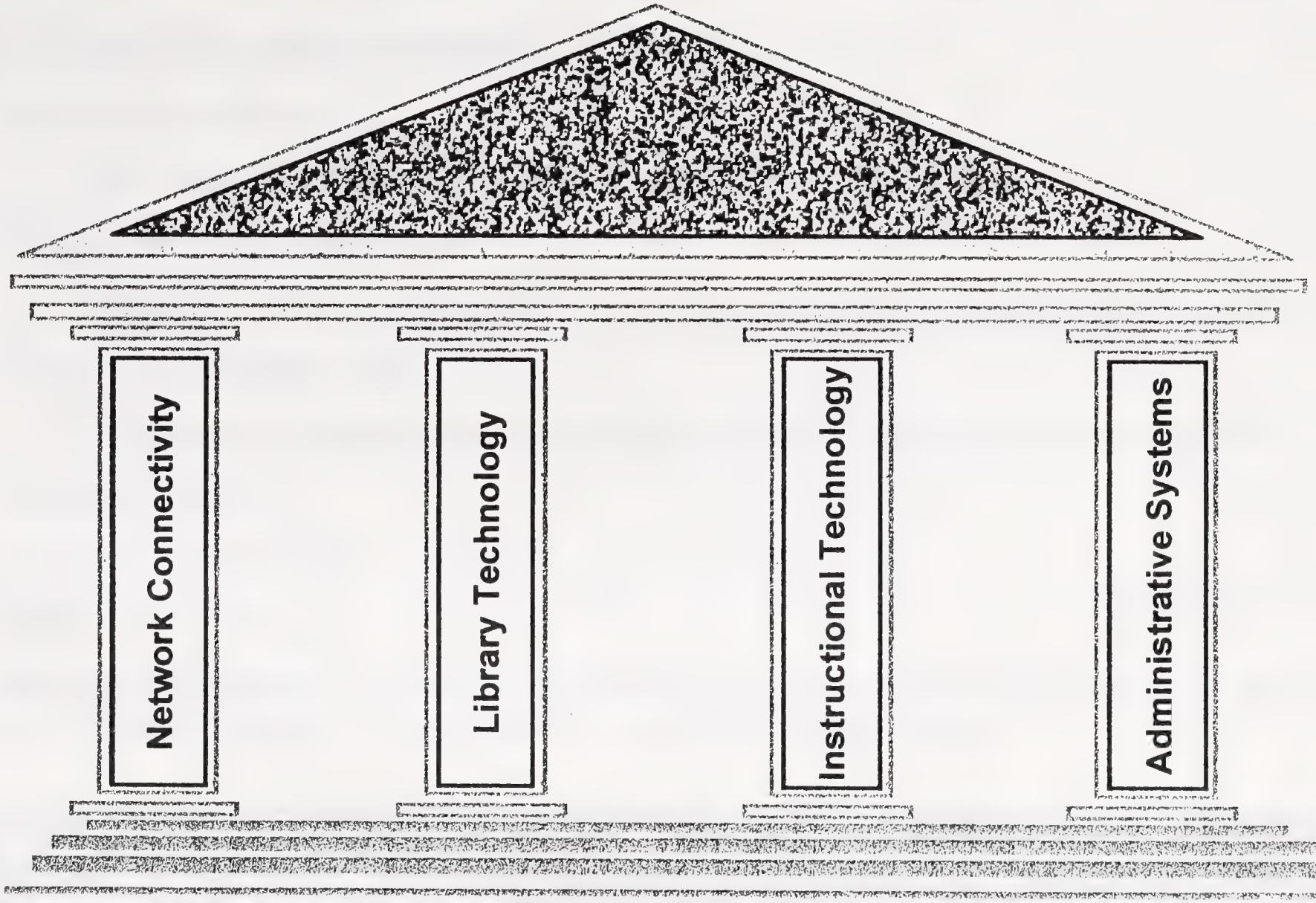
A survey of all 24 campuses in Phase I identified four information technology areas to focus on over the next three years.



Ensuring technical proficiency in these areas will provide the campuses with crucial resources to support their educational mission.

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The survey requested campuses to identify their top three information technology priorities. The following ranking emerged:

Issue (number of campus citations)

- Network Connectivity (17)
  - Data systems infrastructure (15); Remote access (2)
- Instructional Technology (15)
  - Student labs and support (6); Classroom upgrades (5); Distance learning systems (4)
- Administrative Systems (15)
  - Administrative systems upgrade or replacement (14); Document management (1)
- Desktop upgrades (8)
- Telephone systems (2)
- Staffing and Training (1)
- Library Automation (1) * Due to the availability of Library Bond funds, this issue was added to the priority list for inclusion in the assessment and planning process.

Some campus technology needs such as desktop upgrades and telephone system are not addressed in this plan. The Steering Committee determined that desktop computer replacement is a campus responsibility, and that this planning effort should focus on the four primary technology areas.

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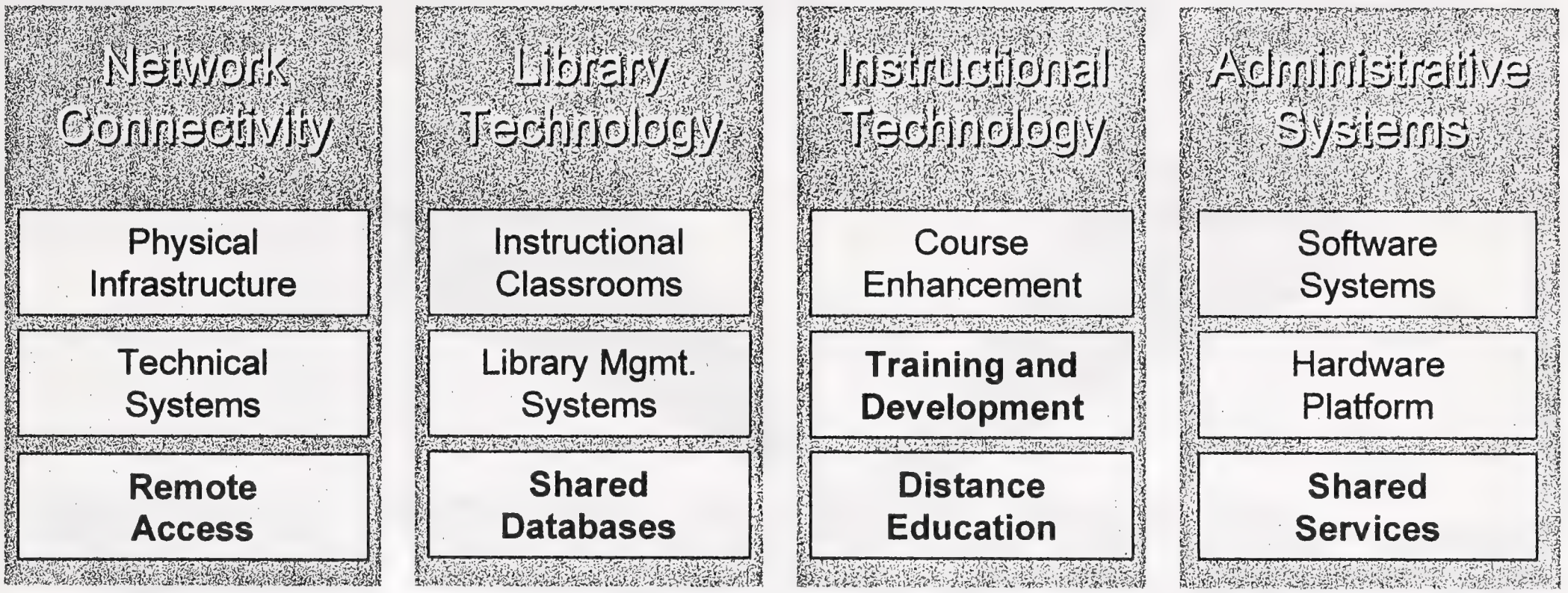
During Phase II, detailed information was gathered about the four major issues, and 12 project categories were defined.



- Bold text indicates collaborative project categories (remote access, etc.) for multiple campuses.
- Remaining project categories (physical infrastructure, etc.) are specific to each campus. However, due to prior investments, campuses do not necessarily have project needs in each category.

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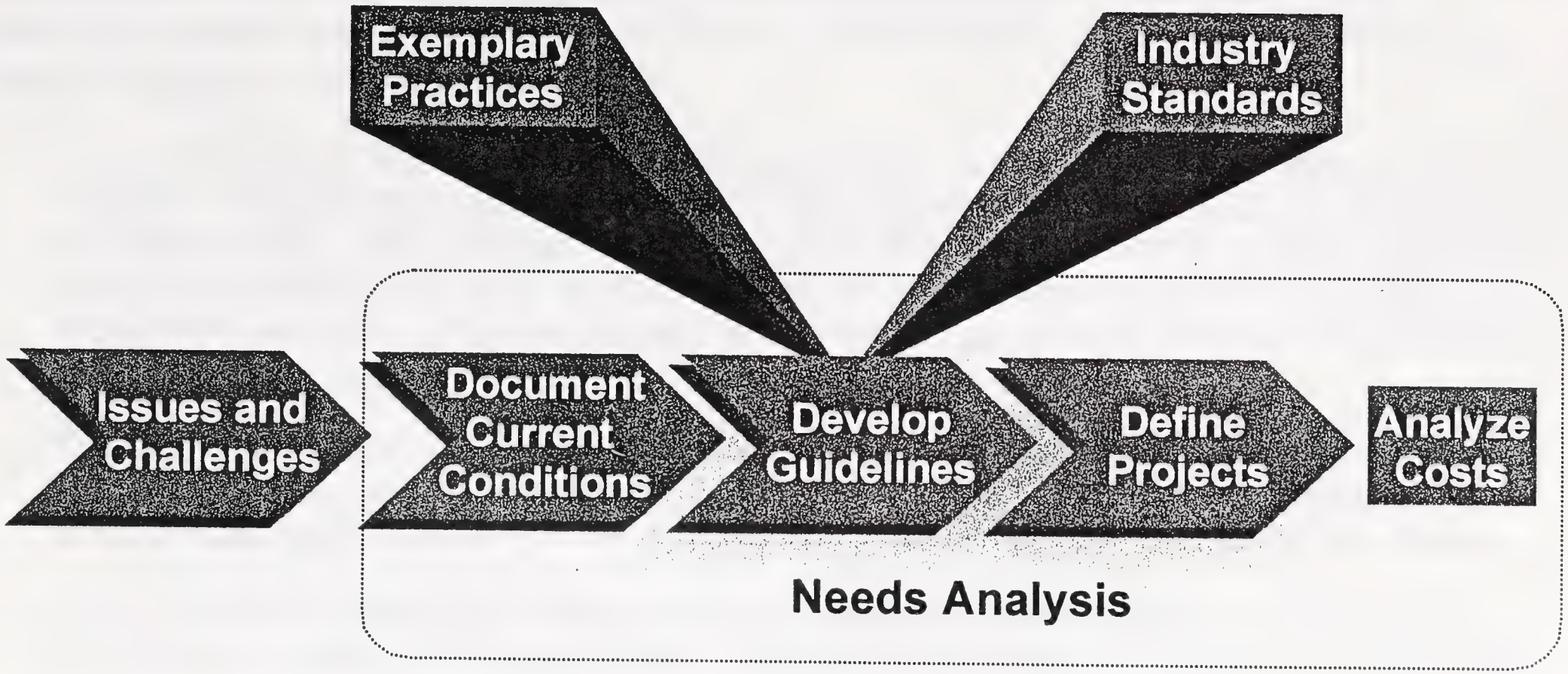
In each category, the state and community colleges conducted a comprehensive planning effort, using a consistent framework for analyzing a broad array of information technology issues and defining the investments needed to achieve their vision.



The campus needs analyses provided information for investment briefs on the projects needed to achieve target levels of technical proficiency.

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Issues and Challenges—Network Connectivity

Networks are being overwhelmed by rapid growth in demands for capacity to support Internet applications, instructional technologies, new administrative systems, online library databases, and other emerging technologies such as Internet II.

- To be technologically competitive with exemplary institutions, the campuses will need reliable network infrastructure with sufficient capacity to carry rapidly increasing video and data traffic. Many higher education institutions are currently making significant capital investments to build up their infrastructure. These investments include new technical systems to provide additional bandwidth as well as new cabling to improve physical connectivity.
- Advanced institutions such as the University of Delaware have had fully networked facilities for over five years. Among the 24 state and community colleges, only Bridgewater and Fitchburg have already completed their physical infrastructure.
- In the future, network technologies should be expected to evolve, necessitating continuous investment in upgrades. After the initial capital investment, institutions should begin treating the network as another campus utility, like the telephone system, with high performance standards and costs recovered by some form of service charge. These charges will provide the funds to maintain the networks at levels competitive with exemplary institutions.

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Issues and Challenges—Library Technology

Libraries are being challenged to build digital collections and train users in new virtual library technologies while still continuing to collect and manage printed materials.

- It is important to recognize the emerging dual mandate for libraries—managing both print and digital materials—and provide adequate funding to accomplish both successfully. The growth in demand for digital resources should not be allowed to undermine the funds available for managing current and future printed matter. The experience of early developers of a "virtual library" shows that it is a complement to printed materials, not a replacement for them.

- The development of a virtual statewide library with online databases and a unified catalog is a significant organizational, technological and financial challenge. Organizationally, there is no entity currently responsible for developing this resource in Massachusetts. Other states such as Georgia, Virginia and California have provided central personnel to develop and deliver this service. Technologically, the current library systems in the state are divided among regional consortia with different systems interfaces. Financially, digital resources can be expensive to license or develop, so a long-term commitment must be made to this effort in order to secure the benefits.

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Issues and Challenges—Instructional Technology

Growing use of instructional technology by faculty and students is creating new demands for training facilities, materials development centers, and support services.

- Currently, the state and community colleges do not have the facilities or staff to support large scale implementation of instructional technology. However, many individual faculty members and staff are experimenting with educational technologies in uncoordinated efforts.
- Leading-edge institutions such as Wake Forest and Johns Hopkins have found that the development and implementation of instructional technology requires a coordinated approach among a broad cross-section of skilled staff. The process depends upon collaboration among personnel with subject matter expertise, advanced technical skills, and knowledge of teaching techniques.
- In addition to staff, adoption of instructional technology requires facilities to develop instructional materials and to train students and faculty in the new media. Training on instructional technology is frequently needed in addition to normal coursework. The challenge is to do this training so that it does not impede the learning process in the subject matter being studied.

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Issues and Challenges—Administrative Systems

Administrative systems designed in the 1980s are facing challenges of limited functionality, antiquated hardware and software, and Year 2000 compliance.

- Many colleges and universities throughout the country have administrative systems with technical limitations that make it difficult to operate efficiently. In Massachusetts, campuses find themselves in a technological trap where they are forced to continue using antiquated business processes because the operations are closely linked to their legacy administrative systems. New systems are intended to provide more data integration and process flexibility to improve administrative efficiency, regulatory compliance, and management reporting capabilities.

- System improvements or replacement often require significant capital investments in hardware, software, and implementation services that many campuses do not have in their operating budgets. These are typically multi-million dollar projects that require 3-4 years to implement fully across financial, human resource, student service, and other process areas.

- Local challenges include providing staff training and change management programs needed to successfully implement the new systems. This process has proven to be particularly daunting in decentralized organizations such as those found in many state systems.

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After analyzing these issues and challenges, the Technology Steering Committee determined the following order of priorities for action.

1. Network Connectivity

- The network infrastructure must be in place before full educational and administrative benefits of the systems and activities can be achieved.

2. Library Technology

- Since libraries are existing centers of academic activity, investments in library technology can result in immediate benefits to the learning process.

3. Instructional Technology

- In the future, instructional technology is expected to have a significant impact on academia. Investments today will build a foundation for this activity and help faculty and students make the transition from traditional to technology-based teaching and learning.

4. Administrative Systems

- The development of efficient and effective administrative services is an ongoing process. Campuses can use these one-time capital investments to improve systems, but then must use operating funds to keep their new administrative systems current.

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Phase III will address the future funding and implementation processes.

Funding

- Supplemental funding allocations have already been made to upgrade the physical infrastructure on the campuses to target levels.
- Requests for Educational Technology bond funds should be completed by the end of fiscal year 1998.
- Release of bond funds to the campuses should occur as quickly as possible.

Implementation

- The physical infrastructure upgrades should be completed in 6-12 months to provide a foundation for the future systems upgrades.
- Major library and administrative systems implementation projects should be completed in 1-3 years depending upon the scope of work.
- Instructional technology should be integrated into the curriculum over a 5-7 year time frame as the faculty become more adept at utilizing the technology.

The success of Phase III depends upon the availability of funds and the local project management on the campuses.

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Development of this plan was facilitated by Coopers & Lybrand and led by the steering committee with significant help from campus technical and library personnel, MBHE staff, and external entities.

Steering Committee

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David McCauley
Jan Motta
William O'Neil
Michael Rivard
Donald Rudge
Ed Terceiro
Adrian Tinsley
Jack Warner

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Laura Chmielecki
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William Davis
Ken Dwyer
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Jack Horrigan
Hank Ingles
Tom Jones
Greg Masterson
Joan McGowan
Barry Neil
Bill Sakamoto
Richard Scaletti
Joe Tolisano

Library Task Force

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Judith Campbell
Mary Curtin
Timothy DiPace
Tamson Ely
Robert Foley
Hal Gibson
David Kelley
Catherine Lee
Carol Letson
Bonnie Mitchell
Mary Ann Niles
Linda Oldach
Laverna Sauders
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Nancy Walker
Linda Weinstein

External Entities

University Information Systems—UMass Amherst
Massachusetts—Information Technology Division

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Network Connectivity is fundamental to providing all other technological services. It must be planned and implemented effectively to create a strong foundation for future IT activities and programs.

Rapid increase in demand for network services requires that the colleges be equipped with a comprehensive infrastructure in order to take full advantage of emerging educational opportunities.

- The standard throughout higher education is the provision of a network connection to every office space, classroom and dorm room. The University of Delaware and Maricopa County Community College District are two of the recognized leaders in IT utilization due to their early development of a networked infrastructure. They have used this to support increased use of technology in courses as well as in the development of distance learning programs.
- The most advanced institutions such as Harvard Business School have wired each seat in their classrooms with network connections. This allows instructors to use instructional technology with students in class for demonstration and interactive lessons.

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Network connectivity is divided into four elements in this plan to facilitate a detailed analysis of campus needs.

Physical Infrastructure	The wiring and connections required to create the network.
Technical Systems	The hardware and software required to activate the network.
Support Staff	The personnel required to operate the network systems.
Remote Access	Access to the Internet and local networks from off campus.

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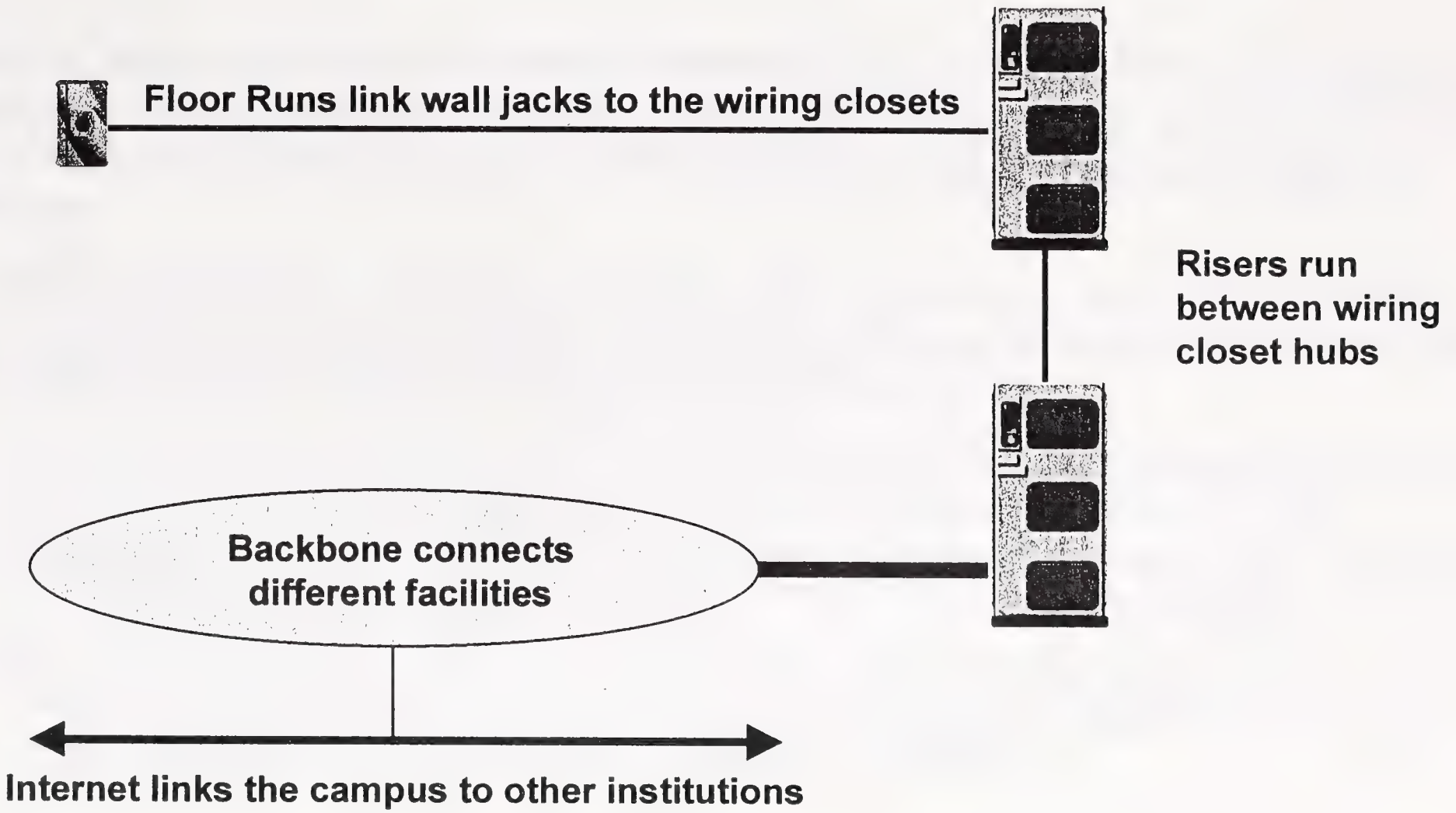
Physical infrastructure consists of three major components - Floor Runs, Risers and Backbone.


Floor Runs link wall jacks to the wiring closets
Risers run between wiring closet hubs
Backbone connects different facilities
Internet links the campus to other institutions

The physical infrastructure must be in place as a foundation for the delivery of the other information systems.

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Exemplary Practices in Physical Infrastructure

Leading edge institutions have invested heavily to build comprehensive physical infrastructures. As with other utilities such as telephone and electricity, the infrastructure is the baseline requirement for service delivery.

- Most institutions have been in a race to catch up with the demand for network connections on campus. Frequently, building physical infrastructure for the network requires costly and time consuming remodeling activities.
- Case Western University, one of the first institutions capable of providing full motion video clips to desktop computers, invested more than $20 million in their asynchronous transfer mode (ATM) network over an eight-year period. They now have a state-of-the-art network to support their advanced engineering curriculum.
- UCLA has developed a $30 million investment program for upgrading its network over a five-year period. This cost includes both new physical infrastructure and an upgrade of their technical systems to state-of-the-art capabilities.

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Physical infrastructure guidelines for the campuses based on exemplary practices and industry standards are:

	FLOOR RUN	RISER	BACKBONE
Minimal	**Category 3 and/or Coaxial**	**Category 5 and/or Coaxial**	**Category 5**
Target	**Category 5**	**Fiber**	**Fiber**
State of the Art	**Fiber**	**Fiber**	**Fiber**

Target guidelines are based on standards that are expected to provide sufficient performance for the next three years.

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The performance levels used as guidelines for information technology systems throughout this report are defined as follows:

- Below Minimal
  - This level of information technology does not provide the campuses with the capability to utilize the growing array of systems and services that are currently available on the market.
- Minimal
  - Systems at this level may be adequate to meet current information technology needs. However, they are not expected to meet future needs as new educational requirements create demands for additional software and hardware.
- Target
  - Target guidelines define systems that should be adequate to handle anticipated campus requirements for the next three years. These are widely available and well tested technologies that the campus personnel should be able to support.
- State of the Art
  - State of the Art systems are mostly experimental at this time and not widely employed in higher education. The most advanced campuses may want to implement test systems, however widespread adoption throughout the System is not recommended because of the higher risk of the technology and the difficulty in finding skilled support staff.

These are technology classifications and not evaluations of campus services. For example, a campus could have a system with "target" technology that is not functioning properly due to a lack of qualified support staff.

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The benefits of implementing the target levels in physical infrastructure include:

Capability to connect rapidly to the network from every workspace, classroom, and dorm room on campus.

- This is a fundamental requirement for providing faculty, students and staff with access to the information resources they require for educational and administrative activities. Like the telephone system, the physical infrastructure for the computer network increases in value as more people have access to connections. Leaving any location unconnected will create a gap in the system that will create islands of isolated users who cannot benefit from the information available to others.

Capacity to handle increased network traffic as the systems and applications become more data intensive.

- The future growth of network load is expected to continue at a very high rate. It is necessary to install a physical infrastructure that can adequately handle projected increases. Implementing the target levels of technology now will allow for growth, enhance current campus resources, and reduce the need to renovate infrastructures in the future to handle new technologies.

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Current Campus Conditions

Physical Infrastructure

Floor Run

State College	Wiring Type	Status	% Faculty Connected	Status	% Staff Connected	Status	% Dorms Connected	Status	% Classrooms Connected	Status	Comments
Bridgewater	Cat5	Target	100%	Target	100%	Target	100%	Target	100%	Target	
Fitchburg	Cat5	Target	100%	Target	100%	Target	100%	Target	100%	Target	
Framingham	Cat5	Target	100%	Target	100%	Target	100%	Target	100%	Target	
Mass. College of Art	Cat5	Target	10%	**Below Minimal**	80%	**Below Minimal**	50%	**Below Minimal**	16%	**Below Minimal**	Connectivity is less than 100% for faculty, staff, dorms and classrooms.
Mass. College of Liberal Arts	Cat3&5	Minimal	100%	Target	100%	Target	35%	**Below Minimal**	30%	**Below Minimal**	Cat3 wiring should be replaced with Cat5. Less than 100% connectivity in dorms and classrooms.
Mass. Maritime Academy	Cat5	Target	100%	Target	100%	Target	80%	**Below Minimal**	24%	**Below Minimal**	Dorms and classrooms are less than 100%. Wiring is there but need more Hubs.
Salem	Cat5	Target	8%	**Below Minimal**	13%	**Below Minimal**	0%	**Below Minimal**	0%	**Below Minimal**	All connectivity is less than 100%.
Westfield	Cat3,5 & Coax	**Below Minimal**	82%	**Below Minimal**	100%	Target	100%	Target	10%	Target	Cat3 & Coax in the floor run should be replaced with Cat5. Less than 100% connectivity in the floor run.
Worcester	Cat5	Target	100%	Target	100%	Target	100%	Target	100%	Target	

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Current Campus Conditions

Physical Infrastructure

Floor Run

Community College	Wiring Type	Status	% Faculty Connected	Status	% Staff Connected	Status	% Dorms Connected	Status	% Classrooms Connected	Status	Comments
Berkshire	Cat3&5	Minimal	100%	Target	100%	Target	N/A		12%	**Below Minimal**	Cat3 wiring should be replaced with Cat5. Less than 100% connectivity in the classrooms.
Bristol	Cat5	Target	80%	**Below Minimal**	90%	**Below Minimal**	N/A		100%	Target	Connectivity in the floor run is less than 100%.
Bunker Hill	Cat5	Target	100%	Target	100%	Target	N/A		90%	**Below Minimal**	Less than 100% classroom connectivity.
Cape Cod	Cat5	Target	100%	Target	100%	Target	N/A		100%	Target	
Greenfield	Cat5	Target	100%	Target	100%	Target	N/A		100%	Target	
Holyoke	Cat5	Target	97%	**Below Minimal**	100%	Target	N/A		100%	Target	Connectivity in the floor run is less than 100%.
Mass. Bay	Cat5	Target	100%	Target	98%	**Below Minimal**	N/A		13%	**Below Minimal**	Connectivity in the floor run is less than 100%.
Massasoit	Cat5	Target	80%	**Below Minimal**	85%	**Below Minimal**	N/A		20%	**Below Minimal**	Connectivity is less than 100% in the floor run.
Middlesex	10base2 & Cat3	**Below Minimal**	59%	**Below Minimal**	80%	**Below Minimal**	N/A		92%	**Below Minimal**	Coaxial in the floor run may need to be replaced with cat5. Connectivity in the floor run is less than 100%.

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Current Campus Conditions

Physical Infrastructure

Floor Run

Community College	Wiring Type	Status	% Faculty Connected	Status	% Staff Connected	Status	% Dorms Connected	Status	% Classrooms Connected	Status	Comments
Mount Wachusett	Cat3&5	Minimal	100%	Target	100%	Target	N/A		13%	**Below Minimal**	Cat3 wiring in the floor run should be replaced with cat5. Less than 100% connectivity in classrooms.
Northern Essex	Cat5	Target	90%	**Below Minimal**	90%	**Below Minimal**	N/A		78%	**Below Minimal**	Connectivity is less than 100% in the floor run.
North Shore	Cat5	Target	50%	**Below Minimal**	90%	**Below Minimal**	N/A		11%	**Below Minimal**	Connectivity is less than 100% in the floor run.
Quinsigamond	Cat5	Target	80%	**Below Minimal**	98%	**Below Minimal**	N/A		39%	**Below Minimal**	Connectivity is less than 100% in the floor run.
Roxbury	Cat5	Target	33%	**Below Minimal**	75%	**Below Minimal**	N/A		59%	**Below Minimal**	Connectivity in the floor run is less than 100%.
Springfield Technical	Cat5	Target	100%	Target	100%	Target	N/A		100%	Target	

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Current Campus Conditions

Physical Infrastructure

Riser

State College	Wiring Type	Status	% LANs Connected	Status	Comments
Bridgewater	Fiber & Cat5	*Minimal*	100%	Target	Cat5 wiring in the riser may need to be replaced.
Fitchburg	Fiber	Target	100%	Target	
Framingham	Fiber & Cat5	*Minimal*	70%	***Below Minimal***	Cat5 wiring in the riser may need to be replaced with fiber. LANs connected to backbone is less than 100%.
Mass. College of Art	Fiber	Target	100%	Target	
Mass. College of Liberal Arts	Cat5	*Minimal*	100%	Target	Ca5 wiring may need to be replaced.
Mass. Maritime Academy	Cat5, coaxial & fiber	*Minimal*	100%	Target	May need to upgrade wiring in riser to fiber.
Salem	Fiber & Cat5	*Minimal*	91%	***Below Minimal***	Cat5 wiring may need to be replaced. LANs connected to backbone is less than 100%.
Westfield	Cat3, 5 & Coaxial	***Below Minimal***	99%	***Below Minimal***	Cat3,5 & Coax in the riser should be replaced by fiber. Less than 100% connectivity in the riser.
Worcester	Fiber	Target	*57%*	***Below Minimal***	Less than 100% connectivity in the floor run and riser.

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Current Campus Conditions

Physical Infrastructure

Riser

Community College	Wiring Type	Status	% LANs Connected	Status	Comments
Berkshire	Coax	**Below Minimal**	100%	Target	Coaxial in the riser may need to be replace with fiber.
Bristol	Cat5	Minimal	20%	**Below Minimal**	Connectivity in the riser is less than 100%. Cat5 in the riser may need to be replaced with fiber.
Bunker Hill	Fiber	Target	100%	Target	
Cape Cod	Cat5	Minimal	20%	**Below Minimal**	Cat5 wiring in the riser may need to be replaced with fiber. LAN Connectivity to backbone is less than 100%.
Greenfield	Fiber	Target	100%	Target	
Holyoke	Fiber	Target	97%	**Below Minimal**	Connectivity in the riser is less than 100%.
Mass. Bay	Cat5	Minimal	100%	Target	Cat5 wiring in the riser may need to be replaced with fiber. Connectivity in the riser is less than 100%.
Massasoit	Fiber & Cat5	Minimal	80%	**Below Minimal**	Connectivity is less than 100% in the riser. Cat5 wiring in the riser may need to be replaced with fiber.
Middlesex	Cat3, 5 & Coax	**Below Minimal**	100%	Target	Cat3&5 wiring in the riser should be replaced with fiber. Coaxial in the riser may need to be replace with fiber.
Mount Wachusett	Fiber	Target	100%	Target	
Northern Essex	Fiber & Cat5	Minimal	100%	Target	Cat5 wiring in the riser may need to be replaced with fiber.
North Shore	Fiber	Target	100%	Target	
Quinsigamond	Fiber	Target	100%	Target	
Roxbury	Fiber	Target	100%	Target	
Springfield Technical	N/A	Target	100%	Target	Only one wiring closet per building, so no risers needed

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Current Campus Conditions

Physical Infrastructure

Backbone

State College	Wiring Type Status		% Buildings Connected	Status	Comments
Bridgewater	Fiber	Target	100%	Target	
Fitchburg	Fiber	Target	100%	Target	
Framingham	Fiber	Target	100%	Target	
Mass. College of Art	Fiber	Target	100%	Target	
Mass. College of Liberal Arts	Fiber	Target	90%	***Below Minimal***	% buildings connected to backbone is less 100%.
Mass. Maritime Academy	Fiber	Target	100%	Target	
Salem	Fiber	Target	50%	***Below Minimal***	Connectivity is less than 100%.
Westfield	Fiber	Target	100%	Target	
Worcester	Fiber	Target	100%	Target	

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Current Campus Conditions

Physical Infrastructure

Backbone

Community College	Wiring Type	Status	% Buildings Connected	Status	Comments
Berkshire	Fiber	Target	100%	Target	
Bristol	Fiber	Target	100%	Target	
Bunker Hill	Fiber	Target	100%	Target	
Cape Cod	Fiber	Target	100%	Target	
Greenfield	Fiber	Target	100%	Target	
Holyoke	Fiber	Target	100%	Target	
Mass. Bay	Fiber	Target	100%	Target	
Massasoit	Fiber	Target	90%	**Below Minimal**	Connectivity is less than 100% in the backbone.
Middlesex	Fiber	Target	80%	**Below Minimal**	Connectivity in the backbone is less than 100%.
Mount Wachusett	Fiber	Target	67%	**Below Minimal**	Connectivity to the backbone is less than 100%.
Northern Essex	Fiber	Target	100%	Target	
North Shore	Fiber	Target	100%	Target	
Quinsigamond	Fiber	Target	100%	Target	
Roxbury	Fiber	Target	100%	Target	
Springfield Technical	Fiber	Target	100%	Target	

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Summary of Estimated Campus Needs

Based on the guidelines in this plan, campuses identified projects needed to reach target levels of proficiency and provided cost estimates for those projects.

Cost estimates for the State Colleges are:

Network Connectivity

Physical Infrastructure

State College	Type	Cost Estimate
Bridgewater		0
Fitchburg		0
Framingham	Floor/Riser	25,500
Mass. College of Art	Floor/Backbone	362,107
Mass. College of Liberal Arts	Floor/Backbone	84,078
Mass. Maritime Academy	Floor/Riser	78,750
Salem	Floor/Riser/Backbone	584,700
Westfield	Floor/Riser/Backbone	508,196
Worcester	Riser	29,000
Subtotal for State Colleges		1,672,331

Detailed project descriptions are provided in the investment brief package.

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Summary of Estimated Campus Needs

Cost estimates for the Community Colleges are:

Network Connectivity Physical Infrastructure		
Community College	**Type**	**Cost Estimate**
Berkshire	Floor/Backbone	96,133
Bristol	Floor/Riser/Backbone	167,494
Bunker Hill	Floor/Riser	64,500
Cape Cod	Floor/Riser/Backbone	317,965
Greenfield	Backbone	93,412
Holyoke	Floor/Riser	46,000
Mass. Bay	Floor/Riser	259,845
Massasoit	Floor/Riser/Backbone	110,805
Middlesex	Floor/Riser	491,454
Mount Wachusett	Floor/Backbone	359,543
Northern Essex	Floor/Riser	131,350
North Shore	Backbone	149,972
Quinsigamond	Floor/Riser/Backbone	286,000
Roxbury	Floor	135,079
Springfield Technical	Backbone	34,073
Subtotal for Community Colleges		2,743,625
TOTAL FOR ALL CAMPUSES		**4,415,956**

Detailed project descriptions are provided in the investment brief package.

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Technical Systems consist of the hardware and software required to activate and access the network. Five segments are analyzed in this plan.

Local Area Network

- LANs provide basic file and print services as well as the critical first link for networking PCs to the backbone. The plethora of protocols, architectures and proprietary systems make it difficult to manage these resources. Ethernet has emerged as the dominant standard.

Backbone

- The backbone architecture should be consistent throughout the campus to increase reliability and reduce network management complexity. Fast Ethernet and FDDI are both proven technologies for these systems.

Protocol

- The seamless exchange of data depends upon inter-operability at the protocol level. Internet Protocol is now a technical standard in the marketplace.

Internet Connection

- A T-1 link between the backbone and the Internet is the most common in higher education at this time. Future demands are expected to drive higher bandwidth requirements.

Remote Access

- The protocols for transmission of data are rapidly evolving in this area. The Point-to-Point Protocol (PPP) is a standard that provides access to local and Internet resources.

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Exemplary Practices in Technical Systems

Leading edge institutions set technical systems standards for each of the components in the network and ensure end-to-end, full service capabilities. The network is only as strong as the weakest link in the technical systems.

- Historically, many colleges and universities have permitted diverse, heterogeneous networks to grow up from departmental local area network systems. This has led to numerous problems with system incompatibilities and network management frustrations.

- Today, exemplary colleges and universities have adopted open Internet standards for their basic network system requirements. These are also being adopted by all vendors of network components as a common denominator for technical systems. These standards provide enhanced interoperability of equipment, reduced network administration costs, and improved access to applications and files. Internet standard technologies are used in this plan to develop guidelines for the campuses. Proprietary protocols, software and hardware are being replaced by the open, standards-based products.

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Technical systems guidelines based on exemplary practices and industry standards for each of the five areas are:

	LOCAL AREA NETWORK	BACKBONE	PROTOCOL	INTERNET	REMOTE ACCESS
Minimal	**Ethernet 10Mbps or Token Ring 4/16Mbps**	**Ethernet 10Mbps or Token Ring 16Mbps**	**Multiprotocol excluding Internet Protocol (IP)**	**Less than T1**	**Serial**
Target	**Ethernet 10/100Mbps**	**Fast Ethernet or FDDI 100Mbps**	**Multiprotocol including IP**	**T1**	**PPP**
State of the Art	**Ethernet 100Mbps**	**ATM 155Mbps or Gigabit Ethernet 1000Mbps**	**IP only**	**T3**	**Secure PPP**

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Implementing the target level technology for technical systems will provide the following benefits.

Reduced network congestion and information transmission delays.

- Many campuses are facing bottlenecks in their networks due to insufficient bandwidth. The target level of 10/100 Mbps Switched Ethernet will provide adequate capacity to support the new loads placed on the network by Internet traffic, library systems, streaming video, client/server administrative systems, and a host of other uses being developed.

Increased manageability of the network.

- Currently, the diverse sets of technical systems found on many of the campuses make it difficult to manage the network. By implementing a single standard across the network, campuses improve their capability to use network management tools such as load monitoring and balancing programs. This reduces the likelihood of systems failure.

Simplified maintenance and repair of the systems.

- If problems do occur, standardization on a single technical system at target level also simplifies the ability to troubleshoot the systems and resolve problems with less downtime and user disruption.

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Current Campus Conditions

Technical Systems

	LAN				Backbone				
State College	Type	Status	Bandwidth	Status	Type	Status	Bandwith	Status	Comments
Bridgewater	Ethernet	Target	10Mbps	Minimal	FDDI	Target	100Mbps	Target	Increase bandwidth of LAN.
Fitchburg	Ethernet	Target	100Mbps	Target	ATM	State of the Art	155Mbps	State of the Art	10Mbps shared on some LANs may need to be increased.
Framingham	Ethernet	Target	100Mbps	Target	Ethernet	Target	100Mbps	Target	
Mass. College of Art	Ethernet	Target	10Mbps switched 10Mbps shared	Minimal	FDDI	Target	100Mbps	Target	Increase bandwidth of LAN.
Mass. College of Liberal Arts	Ethernet	Target	100Mbps	Target	Ethernet	Target	100Mbps	Target	Increase bandwidth of LAN.
Mass. Maritime Academy	Ethernet	Target	10Mbps	Minimal	Ethernet	Target	10Mbps	Minimal	The bandwidth for the LANs and backbone should be increased.
Salem	Ethernet	Target	10Mbps	Minimal	Ethernet	Target	10Mbps	Minimal	The bandwidth for the LANs and backbone should be increased.
Westfield	Ethernet	Target	10Mbps	Minimal	Fast Ethernet FDDI	Target	100Mbps	Target	Increase bandwidth of LAN.
Worcester	Ethernet	Target	10Mbps	Minimal	Ethernet	Target	100Mbps switched	Target	Increase bandwidth of LAN.

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Current Campus Conditions

Technical Systems

	LAN				Backbone			
Community College	Type	Status	Bandwidth	Status	Type	Status	Bandwith	Status
Berkshire	Ethernet	Target	10Mbps	*Minimal*	Ethernet	Target	100Mbps 100Mbps	Target
Bristol	Ethernet	Target	10/100Mbps	Target	Ethernet FDDI	Target	10Mbps	*Minimal*
Bunker Hill	Ethernet Token Ring	Target	10Mbps	*Minimal*	ATM	State of the Art	155Mbps	State of the Art
Cape Cod	Ethernet	Target	10Mbps	*Minimal*	Ethernet	Target	10Mbps	*Minimal*
Greenfield	Ethernet	Target	10Mbps switched	Target	Ethernet	Target	100Mbps	Target
Holyoke	Ethernet	Target	10Mbps	*Minimal*	Ethernet	Target	100Mbps switched	Target
Mass. Bay	Ethernet	Target	400Mbps 10Mbps	State of the Art *Minimal*	Ethernet	Target	400Mbps	State of the Art
Massasoit	Ethernet	Target	10Mbps	*Minimal*	Ethernet Switched Fast Ethernet	Target	10Mbps	*Minimal*
Middlesex	Ethernet	Target	10Mbps	*Minimal*	Ethernet	Target	10Mbps	Target
Mount Wachusett	Ethernet	Target	10Mbps switched	Target	Ethernet	Target	10Mbps	*Minimal*
Northern Essex	Ethernet	Target	10Mbps	*Minimal*	Ethernet	Target	10Mbps	*Minimal*
North Shore	Ethernet	Target	10Mbps	*Minimal*	Ethernet	Target	10Mbps	*Minimal*
Quinsigamond	Ethernet	Target	10Mbps switched	Target	FDDI	Target	100Mbps	Target
Roxbury	Ethernet	Target	10Mbps	*Minimal*	Ethernet	Target	100Mbps	Target
Springfield Technical	Ethernet Token Ring 100VGAnyLAN	Target	10Mbps 16Mbps 100Mbps	*Minimal*	Ethernet Token Ring	Target	10Mbps 16Mbps 100Mbps	*Minimal*

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Current Campus Conditions

Technical Systems

	Protocol		Internet			Remote Access		
State College	Type	Status	ISP	Bandwidth	Status	Type	Status	Comments
Bridgewater	Multiprotocol Including IP	Target	UIS	T1	Target	Serial SLIP/PPP	*Minimal*	Remote access should be upgraded.
Fitchburg	Multiprotocol including IP	Target	UIS	T1	Target	Serial	*Minimal*	Remote access should be upgraded.
Framingham	Multiprotocol including IP	Target	UIS	T1	Target	Serial	*Minimal*	Remote access should be upgraded.
Mass. College of Art	Multiprotocol including IP	Target	Utranet Comm.	T1	Target	PPP CHAP ISDN	State of the Art	Requires additional dial-up lines to increase capacity.
Mass. College of Liberal Arts	Multiprotocol including IP	Target	UIS SSS	T1	Target	Serial	*Minimal*	Remote access should be upgraded.
Mass. Maritime Academy	Multiprotocol including IP	Target	UIS	T1	Target	ISDN PPP	*Minimal*	Remote access is for LAN admin. only. Remote access should be expanded.
Salem	Multiprotocol including IP	Target	UIS	T1	Target	Serial PPP	*Minimal*	Remote access should be upgraded.
Westfield	Multiprotocol including IP	Target	UIS	T1	Target	Serial SLIP/PPP	*Minimal*	Remote access should be upgraded.
Worcester	Multiprotocol including IP	Target	UIS	T1	Target	None	***Below Minimal***	No remote access.

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Current Campus Conditions

Technical Systems

	Protocol		Internet			Remote Access	
Community College	Type	Status	ISP	Band-width	Status	Type	Status
Berkshire	Multiprotocol including IP	Target	Berkshire County Network	T1	Target	Serial	*Minimal*
Bristol	Multiprotocol including IP	Target	UIS	T1	Target	PPP	Target
Bunker Hill	Multiprotocol including IP	Target	ITD	Fractional T1	*Minimal*	PPP	*Minimal*
Cape Cod	TCP/IP	State of the Art	UIS	T1	Target	None	***Below Minimal***
Greenfield	Multiprotocol including IP	Target	UIS	T1	Target	Serial	*Minimal*
Holyoke	Multiprotocol including IP	Target	UIS	T1	Target	SLIP/PPP	Target
Mass. Bay	Multiprotocol including IP	Target	UIS	T1	Target	Serial SLIP/PPP	*Minimal*
Massasoit	Multiprotocol including IP	Target	UIS	T1	Target	Serial	*Minimal*
Middlesex	Multiprotocol including IP	Target	Merrimack Education Center	T1	Target	Serial	*Minimal*
Mount Wachusett	Multiprotocol including IP	Target	UIS	T1	Target	Serial	*Minimal*
Northern Essex	Multiprotocol including IP	Target	UIS	T1	Target	Serial PPP	*Minimal*
North Shore	Multiprotocol including IP	Target	UIS	T1	Target	Serial PPP	*Minimal*
Quinsigamond	Multiprotocol including IP	Target	UIS	T1	Target	None	***Below Minimal***
Roxbury	Multiprotocol including IP	Target	UIS	T1	Target	Serial PPP	*Minimal*
Springfield Technical	Multiprotocol including IP	Target	UIS	T1	Target	PPP	*Target*

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Summary of Estimated Campus Needs

Campuses defined technical systems projects and estimated their cost to reach the target level of technical proficiency.

The estimated costs for State Colleges are:

Network Connectivity

Technical Systems

State College	Type	Cost Estimate
Bridgewater	LAN/Backbone	1,335,000
Fitchburg		0
Framingham		0
Mass. College of Art	LAN/Backbone	355,522
Mass. College of Liberal Arts		0
Mass. Maritime Academy	LAN	176,000
Salem	Backbone	581,244
Westfield	LAN/Backbone	506,000
Worcester		0
Subtotal for State Colleges		**2,953,766**

Detailed project descriptions are provided in the investment brief package.

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Summary of Estimated Campus Needs

The estimated costs for Community Colleges are:

Network Connectivity
Technical Systems

Community College	Type	Cost Estimate
Berkshire		0
Bristol		0
Bunker Hill	LAN	192,000
Cape Cod	LAN/Backbone	155,525
Greenfield	LAN	35,900
Holyoke		0
Mass. Bay	LAN	101,739
Massasoit		362,160
Middlesex	LAN	859,664
Mount Wachusett		0
Northern Essex	LAN/Backbone	674,000
North Shore	Backbone	113,156
Quinsigamond	LAN	54,000
Roxbury	LAN	234,187
Springfield Technical	LAN/Backbone	118,726
Subtotal for Community Colleges		**2,901,057**
TOTAL FOR ALL CAMPUSES		5,854,823

Detailed project descriptions are provided in the investment brief package.

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Support staff requirements are growing rapidly as network connectivity increases.

The traditional networked environment consisted mostly of administrative staff using desktop computers from 8am to 5pm. The applications were typically standardized for the group and software use was restricted.

- In this environment, the traditional industry benchmark for the number of desktop computer support personnel is one full time equivalent staff person (FTE) for every 100 computers. Support personnel include PC technicians and help desk operators. This ratio does not include network technicians or application programmers who might also work with end-users but do not service PCs.

However, recent network growth has been in faculty and student (dorm and lab) users who are working at all hours of the day and night. These new users typically use more complex software applications and require more advanced support services.

- A 1997 survey by Coopers & Lybrand of leading-edge institutions using instructional technology such as Harvard Business School found a benchmark of one help desk/PC support FTE for every 50 computers to meet increased service demands.

The actual number of support staff required by each campus depends upon the level of network connectivity and utilization patterns.

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The trend is toward even more reliance on the network and, hence, more demand for support staff.

The most advanced users now are demanding service levels equivalent to the telephone system with 100% network reliability, 24 hours per day. These state of the art service levels are not achievable without significant resource commitments to infrastructure and support personnel.

- Based on the experience at the leading-edge institutions, over the next five years campuses should plan to attain a 1:50 staffing ratio in order to provide adequate support for more complicated networks and more intensive users.

However, this ratio may need to be even lower in the future due to growth in mobile laptop computing, remote access, and classroom use of technology.

- Classroom use of technology, for example, has resulted in an increase in support staff dedicated to ensuring that the technology functions properly during the class period. Class time is extremely limited and faculty are not willing to risk losing any time to technical problems. In addition to more staff, current staff may need new skill sets to handle changing environments and technologies for instructional technology.

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Campus Staffing Level Guidelines

Campuses should review their current network and desktop support staffing levels to determine if they reach the industry benchmark of one support person for every 100 computers.

- If they are below that level, then the campus should consider providing additional operating funds to increase staffing levels in these areas.

For colleges beginning to develop advanced programs, such as distance education and instructional technology, plans should be developed to increase the number of support staff beyond the industry benchmarks.

- The 1:50 ratio should be a future target for the most advanced campuses that are already providing network services in student dorm rooms, classrooms, and via remote access modems. The demands for network staff in those environments will increase tremendously because of the wide diversity of equipment being connected to the network. Campuses risk losing good staff to burnout if they do not anticipate this increase in demand for support and provide sufficient resources to handle the workload.

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Collaborative Opportunity—Remote Access

The campuses have identified common remote access services as a potential collaborative opportunity for the system.

- Remote access capability is growing in importance as more instructional and administrative materials are placed online. Faculty, staff and students require remote access to digital library materials, administrative systems, and files shared for collaborative work.
- To meet those needs, state and community colleges want to provide the most economical and effective solution possible for remote access to the Internet and to their campus networks.
- However, the cost of providing these services is growing dramatically, because the technology is becoming obsolete every 12-18 months. Campuses have found that they cannot afford these continuous infrastructure upgrades. Collaboration provides a means for all campuses to stay abreast of the technology in the most efficient manner.

This plan provides a strategic framework for evaluating shared remote access, but technical work beyond the scope of this effort will still be required to successfully develop the service.

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Exemplary Practices and Industry Standards

The trend in higher education is toward outsourcing remote access to a private sector Internet Service Provider (ISP) such as AT&T, MCI, or one of hundreds of other companies that are offering these services.

- The vision at exemplary institutions is to provide all faculty, students and staff with seamless access to the educational systems from anywhere in the World at anytime.
- Dozens of institutions including UC Berkeley, North Carolina State, and Georgetown have determined that there are several significant advantages to outsourcing this service. First, the cost of maintaining the systems and staffing internally are rising so dramatically that it is virtually impossible to budget for the rapidly increasing capital and operating costs. Second, the support services of the ISPs are better prepared to respond to changing customer needs. Third, the ISPs are more capable of implementing the latest modem technology for higher speed connections.
- These dial-in services have become a commodity in the marketplace and price competition is fierce. Colleges and universities are taking advantage of this competition to drive the cost of providing the services down.
- Some of the state and community colleges are already outsourcing their remote access to an ISP. Holyoke Community College, for example, has signed an outsourcing contract with IBM that will make worldwide remote access services available to faculty and staff from that campus.

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Exemplary Practices and Industry Standards

Massachusetts Department of Education has partnered with an ISP (JavaNet) to provide low cost internet access to K-12 educators called MassEd.Net.

- Who is eligible?
  - MassEd.Net is available today exclusively to K-12 educators who are employed by a Mass. Public school or a public agency offering educational programs.
- Who provides ISP service?
  - JavaNet
- Who pays for the service?
  - Individuals pay $25.00 a year.
- How will it be administered?
  - Register through web site (www.massed.net) or use registration form. Software can be downloaded from the internet or mailed to user. JavaNet will provide technical support, 24 hours a day, seven days a week, 365 days a year.
- What services will be provided?
  - You can send and receive e-mail, join e-mail lists, visit the World Wide Web, read and post to newsgroups, transfer files and software, and everything else that a full-service Internet connection enables.

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Current Campus Conditions

Currently, each campus has to provide remote access on its own, resulting in a wide variation in capabilities.

- Some colleges have sophisticated modem pools, others have individual modems attached to PC's running PC Anywhere. There are also some that do not have a solution in place. The campuses already providing this service have to maintain complex systems that must be upgraded frequently to keep pace with the changing technology. They do this with very limited IT staff to set up and operate the services.

This situation is costly and inequitable.

- This situation imposes a cost on each campus to maintain its own systems and skilled staff. There is no economy of scale, and users living outside the local calling area for the college must pay long distance charges on top of the campus costs.
- At campuses without remote access systems, the students, faculty and staff lack equal access to learning resources available to others in the system. The migration of more learning materials and systems to the Internet will place them at a greater disadvantage if something is not done to ensure their access to electronic resources.

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Current Campus Conditions

Remote Access

State College	Hardware	Internet	LAN Admin	Local File Servers	Library Systems	Admin Systems	Mainframe	Comments
Bridgewater	Cabletron RAS Motorola Modems Digital Terminal Servers Teleglobe Modems CISCO Routers		✓	✓	✓	✓	✓	E-Mail.
Fitchburg	Telebit Net Blazer	✓	✓	Some Individuals				
Framingham	10 - 14.4 Multitech modems 10 - 28.8 USRobotics Modems 10 - 28.8 Motorola Modems w/PC Anywhere							The use of the modems are unknown.
Mass. College of Art	Livingston Portmaster 2e/ISDN USR v Everything modems	✓	✓					E-Mail
Mass. College of Liberal Arts	Microcom QT92/QX Chassis (16) 24 - Deskporte 28.8 Rackmt modems							E-Mail
Mass. Maritime Academy	HP LAN Adaptor		✓					Vendor Support.
Salem	Xyplex Terminal Server MultiTech Modem Pool							E-Mail
Westfield	CISCO 516 RAS	✓		✓		✓	✓	Campus Services
Worcester	None							No remote access

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Current Campus Conditions

Remote Access

Community College	Hardware	Internet	LAN Admin	Local File Servers	Library Systems	Admin Systems	Mainframe	Comments
Berkshire	7 - 28.8 USRobotics modems 1 - modem control DEC Server 200						✓	Support VAX & phone system. E-Mail.
Bristol	CISCO Router 2511 16 - 33.6 Micron modems			✓		✓		E-Mail
Bunker Hill	16 - MicroCom 28.8 modems hooked up to 2 Annex term servers	✓	✓					E-Mail
Cape Cod	None							No remote access
Greenfield	3Com Terminal Servers Boca 14.4 modems		✓					E-Mail. Remote administration from computer services staff.
Holyoke	Shiva LAN Rover/E Plus	✓				✓		E-Mai, VAX, Internetl
Mass. Bay	USR modems Digital Terminal Server Digital RAS on OVM							
Massasoit	2 - Codex 3260 modems 1 - CISCO 2500 Router 1 - Codex 3500 DSU/CSU							No remote access.

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Current Campus Conditions

Remote Access

Community College	Hardware	Internet	LAN Admin	Local File Servers	Library Systems	Admin Systems	Mainframe	Comments
Mount Wachusett	3 - modems							Vendor Support. Distance Learning. Special File Transfer.
Northern Essex	Xylogics Annexts							E-Mail & Databases.
North Shore	IBM 8235	✓				✓		E-Mail
Quinsigamond	None							No remote access
Roxbury	LANRover 8E Shiva Remote Access 5 - 28.8 Multitec modems							
Springfield Technical	1 - USRobotics Total Control Network Hub w/4 Quad-v.34+ modems 1 - IBM PC Server w/16 port Digiboard 6 - USRobotics Courier Dual Standard 14.4 modems 1 - IBM	✓	✓	✓	✓	✓		E-Mail

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The issues that need to be considered as part of this collaborative opportunity include:

- Who participates? (All or some campuses)
- Who provides the services? (e.g., college, ISP)
- Who pays for the services? (e.g., college, users)
- Who has access? (e.g., faculty, staff, students)
- How will it be administered? (e.g., registering and supporting users)
- What services will be provided? (e.g., E-mail, Domain Name Services, Internet, run local applications, retrieve local data, perform remote system administration)
- How will technical operations be managed? (e.g., security, IP addressing, encryption, authentication)
- What are the operating standards for remote access? (e.g., reliability, modem upgrade cycles, service levels)

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Issues and Options - Summary Chart

Who Participates	Who Provides	Who Pays	Who Has Access	Who Administers the Services	What Services are Provided	Who Handles Technical Operations	What Operating Standards
All Colleges	College	College	Faculty	ISP	Internet – Web browser	ISP	Reliability
Some Colleges	ISP	Faculty	Staff	Central Agency	Electronic Mail	College	Modem Speeds
		Staff	Students	College	Local File Servers	UIS at UMass Amherst	Protocols Supported
		Students			Library Applications		Connectivity Limitations
		MBHE (start-up costs)			Administrative Applications		Service Levels
					Mainframe		Modem Upgrade Cycles

The options in the columns are not necessarily mutually exclusive. The final determination of services, participation, payment, etc. may result in several alternatives for campuses.

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Issues and Options

Who participates?

- This program need not be an "all or nothing" arrangement for the campuses in order to be successful. Given the different levels of preparation and need for these remote access services, there should be flexibility for campuses to decide if they want to participate.
- While all have expressed great interest, this program should utilize an approach similar to the arrangement for Internet service. That program gave the campuses the option of going with the preferred vendor (UIS) or making separate arrangements as they saw fit.
- However, the selected ISP may require a certain minimum number of subscribers. This means that some preliminary agreement to participate will need to be secured among a core group of campuses to make the overall program economically viable.

Recommendation: Authorize a procurement team to develop the guidelines for the service and secure a preliminary agreement with campuses that express an interest in participating in the program.

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Issues and Options

Who provides remote access?

- As previously noted, the best practice today is to outsource the provision of this service to an ISP.
- The benefits of this arrangement include:
  - Reduced capital and operating costs for campuses
  - Economy of scale in service provision which results in lower costs to users
  - Increased numbers of access lines to reduce busy signals and local calling zones to reduce the cost of calls
  - Consistent and reliable security and encryption standards through the ISP
  - Increased capability to share information between campuses
- The drawbacks are:
  - Dependence on an external entity for an increasingly important service
  - Increased effort required to coordinate multi-campus policies and procedures with the ISP

Recommendation: Outsource the statewide provision of remote access to an Internet Service Provider.

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Issues and Options

Who pays for remote access?

- Currently, some colleges pay for remote access by providing free dial-in capability via a campus modem pool. This is a hidden subsidy for the users. Many institutions throughout the country have started to move away from this practice. They are implementing direct charges to users or outsourcing to an ISP which bills users.
- Each campus should determine how it wants to handle the costs of this service. For example, a college could decide to pay for faculty and staff costs to ensure that they can work from home, but require students to pay a fee for remote access. Or the campus could require everyone to pay for the service individually. This decision will depend, in part, on the educational programs and needs of the local users.
- There also could be a need to provide start-up funds for the process of defining the services, issuing and evaluating the request for proposals, and negotiating with the Internet Service Provider. The Board should allocate $250,000 to cover any expenses related to the initial cost of selecting and implementing the services.

Recommendation: Allow each campus to determine how it wants to handle the payment structure for students, faculty and staff. Provide $250,000 in start-up funds to cover any costs which may arise in the process.

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Issues and Options

Who uses remote access?

- Each college should also determine who they want to let access their LAN via remote access. Faculty and staff may require access to perform their jobs, while students may not have a need for remote access. As with payment, this decision may be left up to each individual campus.
- To ensure smooth implementation, there should be a program for exploring options for bringing different user groups online. For example:
  - Beta test a roll-out program with one or two campuses.
  - Phase the access—First round faculty and staff; second round students.
- A key question is, which students will have remote access? (full-time, part-time, students enrolled in particular classes, etc.)
  - This is a key policy question and should be standardized for the entire system to minimize potential abuse of the service discounts.

Recommendation: Provide the service to faculty and staff first, and after they have had time to learn how to use it, open it up to students.

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Issues and Options

Who administers remote access?

- There are potentially different roles for each entity in this task.
  - Users could subscribe directly with the ISP or go through an administrative process on campus to request service.
  - Campuses could administer the enrollment or simply send a data file of authorized users to the ISP for use when verifying requests for service.
  - ISP could administer the entire program, or simply create ID's and passwords based on registration processes on each campus.
- Given the diverse nature of the current systems and the large scale of any unified remote access operation, this issue will need to be carefully planned and standardized for all colleges to ensure the most efficient administrative services. To coordinate that effort, a governing body will be needed. The Coordinators of Information Technology in Education (CITE) is an established group with representatives from each campus that could play this governance role.

Recommendation: The most efficient service can be delivered by having the ISP administer the registration based on the official lists of authorized users sent by the campus in electronic format to the ISP. CITE could serve as the governing body to ensure coordination of the services.

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Issues and Options

What services are provided?

- The optimal situation for users is to have access to all services currently available on their local area network connection. Unfortunately, the level of systems complexity and diversity on the campuses make it impossible for an ISP to deliver that service universally. Therefore, a determination must be made of what services will be provided and when.
- The most viable approach is to provide easily supported services as part of an initial roll-out and then add more access as the relationship with the ISP matures and the campus systems are upgraded to Internet standards.
  - Phase I—Internet/World Wide Web browser capability, E-Mail (ISP or Campus POP or IMAP systems)
  - Phase II—Access to Local File Servers inside the campus firewall.
  - Phase III—Connection to administrative applications.

Recommendation: Negotiate the phases with the ISP and develop beta sites to test the viability of access to local file servers and administrative systems.

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Issues and Options

Who handles technical operations?

- The ISP should be responsible for technical support for end-users.
- Security is a particularly difficult issue due to the technical complexity of the systems. A standard set of security policies and procedures must be developed to ensure maximum safety without overly restricting access. This will need to be a joint effort by the ISP, UIS and each individual campus.
  - The Campuses will have to administer their own firewalls to protect local systems. To do so, they will need to get information from ISP to make appropriate changes and coordinate their security system activities.
  - The ISP will have to assign ID's and passwords to users and monitor their authorization to use the dial-in modem facilities. The ISP will also need to work with the campuses to coordinate firewall access to local systems and applications.
  - UIS will need to be responsible for maintaining their system-wide security created as part of the current campus Internet connection services.

Recommendation: Require the ISP to provide a defined level of technical support. Establish security standards and procedures in cooperation with the ISP.

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Issues and Options

What operating standards will be used?

- This is a central question in the selection and negotiation process for an ISP. These standards must be defined by the campuses before any effort is made to select an outsourcing partner.
- Campuses will need to agree upon such standards as the level of reliability for modem access, the service call response time, the minimum modem speeds, etc. These will then be used by the procurement team to evaluate the competing ISP offers and their ability to meet the criteria.
- The technical details in each of these areas is beyond the scope of this strategic plan, but there are numerous examples available on the Internet of other university's operating standards that can be used to create a framework for proceeding rapidly through the procurement process. See the appendices for a form used by one university to determine the ISP's ability to achieve the desired operating standards.

Recommendation: Develop system-wide operating standards to serve as the core of the ISP selection process.

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Summary of Recommendations for Collaborative Remote Access

Who Provides Remote Access?

- Internet Service Provider

Who Pays for Remote Access?

- Each campus decides how to handle this issue individually
- Board allocates $250,000 for start-up costs

Who uses the service?

- Initially roll out services to faculty & staff
- Open the service to students within 12 months

Who administers the service?

- Primarily the ISP, with support from the colleges

What services are provided?

- Initially, Internet & e-mail
- In the future, provide access to Local File Servers, applications, mainframes, etc.

Who handles technical operations?

- ISP provides technical support help desk; security is jointly determined

What operating standards will be used?

- Create concrete operating standards to use as part of the ISP selection process

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Libraries are an important part of the process of introducing technology to the learning environment and providing access to new digital information resources.

In this changing environment, it is important to provide a balance of library services including access to digital materials, training on how to use them, and management of the information resources.

- The World Wide Web provides new ways to access information within the library and throughout campus. Campuses must build the information infrastructure to support this expanding realm of library activity.
- Successful use of digital information will require adequate training in how to find the new library resources and apply the tools effectively. Students and faculty will need extra support over the next few years to learn how to effectively use the rapidly expanding array of digital resources.
- These library services and systems often initially appear to be one-time capital expenses, however the campus investment in ongoing operating support is equally important. Building the infrastructure of databases and access points is just the first step in delivering improved information resources. The commitment to support these systems in the future with training is crucial to the development of effective digital resources.

Investing in these areas will provide students and faculty with access to the new digital library materials and the skills to use them effectively.

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Four library technology areas have been identified as investment priorities in this plan.

Library Instructional Classrooms	Facilities to provide students, faculty and staff with training on the use of the new digital library resources and course materials.
Library Management Systems	Third generation packaged solutions that provide enhanced functionality using Web access and adherence to industry standards.
Digital Microform Reader/Printer Systems	A technology that allows traditional microforms (microfilm and microfiche) to be read as digital images so that they can be stored and sent electronically.
Shared Digital Library Resources	A collaborative arrangement to achieve economies of scale for licensed online databases that are Web accessible.

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Library instructional classrooms are needed to train faculty and students in the use of new digital information sources.

Library users are increasingly reliant on digital sources to gather information and conduct research.

- This is creating a demand for training for faculty members and students. In spite of growing familiarity with technology, campuses cannot assume that their patrons will be knowledgeable about the particular programs or library databases available. Therefore, there must be a facility where this training can occur.

Libraries have traditionally served as the key center for faculty and student development of information search strategies.

- Many institutions are using the library as the site for faculty and student training on the new information gathering tools and digital resources. University of California at Los Angeles, for example, has developed an instructional technology center as part of the library staff to support these efforts.

Library instructional classrooms are a fundamental resource for introducing faculty and students to the new digital information sources.

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Exemplary practices for instructional classrooms exist at many institutions.

The Universities of Arizona and Delaware have both created instructional classroom facilities where their libraries and IT units cooperate to train faculty and students.

- The library provides the facilities and trainers and the IT unit sets up and maintains the technology infrastructure. These early efforts have been successful in bringing the strengths of both groups to the training effort.

Many of the larger campuses have a strategy of setting up multiple instructional classrooms.

- Often the library hosts the instructional classroom and a separate faculty training and development center. Individual programs provide more targeted instructional facilities that are used to train students on software needed in their field of study, such as geographic information systems for use in urban planning.

Instructional classrooms are considered a necessity at leading edge institutions because everyone is expected to know how to use the latest technology. Programs at these local training facilities should be integrated with those at the four regional Instructional Training Centers described later in this plan.

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Instructional classrooms can be configured in many ways, but there is a set of fundamental components that should be included.

Hardware

- Pentium class workstations, servers, laser and dot matrix printers, scanner, data projector and screen.

Networking

- High-speed LAN connections, network management software.

Software

- Databases and other information resources, windows operating system, Web-browser, office suite, E-mail, other software as needed by faculty.

Facilities and Furnishings

- Computer tables, adjustable chairs, an ADA compatible station, dimmable lights, adjustable window covering, adequate HVAC systems.

This new training facility should be treated as a "turn-key" project which includes all of the necessary components to ensure that it is constructed properly and immediately useful to the faculty and students.

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Current Campus Conditions

Currently, only Bridgewater State College has an adequate library instructional classroom. The remaining 23 campuses require a facility to support the faculty and student training and development efforts.

- Bridgewater State developed a library instructional classroom in 1997. It contains approximately 20 workstations set up in small clusters, an instructional control panel, projection equipment, and printers.
- The room and furniture have been designed to emphasize the role of information resources in collaborative, group-based learning within the context of a learning community.
- The entire facility is connected to the campus network for high speed access to the Internet. Software includes a basic office suite, Web browser, library database links, and some specialty course software.

Lessons learned in the design of the facility at Bridgewater State helped the Task Force develop the criteria for an effective instructional classroom.

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The benefits of providing library instructional classrooms include:

Improved ability to train faculty and students on the use of digital library materials and courseware.

- For most campuses, this classroom will be the first space equipped specifically to support instruction on how to use the new digital information resources. These resources are growing rapidly, so students and faculty must be capable of utilizing them effectively. The classroom will help produce students who are well prepared to use the emerging digital sources of information.

Enhanced capability to teach classes using courseware and multimedia technology.

- The classrooms will play a valuable role in introducing technology directly into the learning process. Faculty will be able to schedule the facility and bring their students for hands-on training. This is a significant advancement in the capabilities of most of the campuses, which are struggling to meet faculty needs for these types of resources.

Exemplary design for future instructional classroom development by the campuses.

- Eventually, there will be many instructional classroom facilities on the campuses. This first one will provide a model for the development and use of such classrooms, helping the faculty learn what works well and what needs to be improved in future versions.

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Summary of Estimated Campus Needs

Campus staff identified locations and prepared cost estimates for library instructional classrooms at each of the 23 campuses that lack an adequate facility at this time.

The costs of the library instructional classrooms for the State Colleges are estimated to be:

Library Instructional Classroom

State College	Cost Estimate
Bridgewater	0
Fitchburg	100,000
Framingham	73,000
Mass. College of Art	100,000
Mass. College of Liberal Arts	98,750
Mass. Maritime Academy	163,500
Salem	116,450
Westfield	121,735
Worcester	110,495
Subtotal for State Colleges	**883,930**

Detailed project descriptions are provided in the investment brief package.

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Summary of Estimated Campus Needs

The costs of the library instructional classrooms for the Community Colleges are estimated to be:

Library Instructional Classroom	
Community College	**Cost Estimate**
Berkshire	111,300
Bristol	120,050
Bunker Hill	103,130
Cape Cod	75,900
Greenfield	153,800
Holyoke	81,775
Mass. Bay	70,900
Massasoit	279,000
Middlesex	171,650
Mount Wachusett	101,850
Northern Essex	151,696
North Shore	237,256
Quinsigamond	133,050
Roxbury	234,675
Springfield Technical	100,680
Subtotal for Community Colleges	**2,126,712**
TOTAL FOR ALL CAMPUSES	**3,010,642**

Detailed project descriptions are provided in the investment brief package.

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Existing library management systems at some of the campuses are no longer adequate for the librarian's or user's needs.

Legacy mainframe systems developed in the 1980s do not support the new standards for online catalog, circulation, and acquisitions functions.

- The modern library management system (LMS) meets the Z39.50 standard that permits the user of a local online catalog to search the online catalog of another library using the familiar commands, structure and presentation of the local system. They also include technologies that have become standard in the software industry, such as client-server architecture, graphical use interface, and Year 2000 compliance.

Faculty and students want to have full access to library information from PCs outside of the library.

- They require full functionality via a Web browser, so that they can conduct research from locations outside the library. Many of the libraries are currently working with systems that rely on 'dumb terminals' or terminal emulation programs that are not designed for easy Web access.

Modern LMS's with seamless Web access are crucial to providing faculty and students with a state-wide 'virtual library' in the future.

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Exemplary Practices with Library Management Systems

Leading-edge libraries are implementing third generation management systems with improved functionality, Z39.50 compatibility, and Web interfaces.

- Advanced library management system users such as UCLA are now replacing their legacy mainframes with new client/server systems. These institutions are serving as development partners with the vendors of the latest systems to ensure improved functionality for the users.
- Vendors have now adopted the Z39.50 and other standards, which open up new opportunities for libraries to share data. Faculty and students using these systems can now take advantage of shared catalogs from multiple libraries. The Florida Center for Library Automation provides this type of shared library management features for all of its member institutions.
- Web interfaces on the new systems simplify information access by allowing users to get to the data from anywhere at anytime.

These features will allow faculty and students to access and utilize the library information resources more easily

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Guidelines for the Library Management System include:

Year 2000 compliant

- Both software and hardware are certified by the vendor as compliant.

Vendor supported system (ongoing vendor support is available)

- Older systems that are no longer supported should be replaced.

Supports bibliographic queries via the Z39.50 standard

- Data can be readily exchanged between systems with minimal programming.

Offers patron services via a WWW interface

- All public information such as publication data and current document status can be obtained from any Web browser.

Provides integrated library management services (acquisitions, cataloging, circulation, OPAC, serials, etc.)

- Seamless systems are needed for efficient management.

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Current Campus Conditions

The current library management systems are provided by a complex mix of consortia and individual campus systems.

- Nineteen colleges utilize systems provided by consortia that include university, college, K-12, and community libraries:
  - Central/Western Mass. Automated Resource Sharing (C/W Mars)—8 colleges; North of Boston Library Exchange (NOBLE)—4 colleges; Southeastern Automated Libraries (SEAL)—2 colleges; Cape Libraries Automated Materials Sharing (CLAMS)—1 college; Fenway Libraries Online—1 college; Minuteman Library Network—1 college; UMass Lowell shared system—1 college; UMass Dartmouth shared system—1 college.
- Four colleges currently have their own LMS.
- One college has no LMS and relies on manual processing

The Library Task Force considered the creation of a single, statewide library management system for MBHE schools similar to the one in Florida.

- However, it concluded that the current set of collaborations are working reasonably well in most cases. Therefore, it is not imperative to restructure them just for technical reasons.

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Current Campus Conditions

Library Management Systems

State College	Software Vendor	Software Package	Hardware Platform	Single or Shared	Consortium	Retain, Replace, or Repair	Year 2000 Compliant	Vendor Support	Z39.50 Compliant	OPAC Web-Accessible
Bridgewater	DRA	MultiLIS 11.1	DEC VAX/ Alpha at Umass Dartmouth	Shared with UMass Dartmouth	UMass Dartmouth	Replace	No	Yes	No	No
Fitchburg	C/W MARS	CARL	Tandem at Central Site	Shared	C/W MARS	Replace in 2 years	Yes	Yes	Yes	No
Framingham	DRA		Digital Alpha 4100	Shared	Minuteman Library Network	Retain	Yes	Yes	Yes	Yes
Mass. College of Art	DRA	DRA Classic 2.5	Alpha 1000	Shared	Fenway Libraries Online	Retain	Yes	Yes	Yes	Yes
Mass. College of Liberal Arts	C/W MARS	CARL	Tandem	Shared	C/W MARS	Replace in 1999	In process	Yes	In process	No
Mass. Maritime Academy	Ameritech	Dynix 152	HP9000	Shared	SEAL	Retain and change within next year	Yes	Yes	Yes	Yes, by 1998
Salem	Geac	Geac Plus 2.5.3	Sequent at NOBLE	Shared	NOBLE	New system by end of '98	Yes	Yes	No	No
Westfield	Endeavor	Voyager 97.1.1	Sun server	Single	No	Retain	Yes	Yes	Yes	No
Worcester	C/W MARS	CARL	Mainframe in Paxton	Shared	C/W MARS	Replace in Jan. '98 with C/S Endeavor system	No	Yes	Yes	Yes

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Current Campus Conditions

Library Management Systems

Community College	Software Vendor	Software Package	Hardware Platform	Single or Shared	Consortium	Retain, Replace, or Repair	Year 2000 Compliant	Vendor Support	Z39.50 Compliant	OPAC Web-Accessible
Berkshire	C/W MARS	CARL	TANDEM	Shared	C/W MARS	Replace in '98	In process	$13,500	Yes	No
Bristol	DYNIX	Ameritech Version 152	HP 9000	Shared	SEAL	Retain	Yes	Yes	Yes	Yes, by 1998
Bunker Hill	GEAC	Geac Plus	Sequent at NOBLE	Shared	NOBLE	Replace in 1998	Yes	Yes	Yes	No
Cape Cod	DRA	Atlas 2.4-2	DEC Alpha 2100 4/200 running on VMS 7.1	Shared	CLAMS	Retain and upgrade in Jan. '99	Yes	Yes	Yes	No
Greenfield	C/W MARS	CARL	Tandem	Shared	C/W MARS	Replace within 2 yrs	No	Yes	Yes	No
Holyoke	C/W MARS	CARL	Tandem	Shared	C/W MARS	Replace within 2 yrs	?	Yes	?	No
Massasoit	Ameritech	Horizon	Microsoft NT Servers run on NEC	Single	No	Retain	Yes	Yes	Yes	Yes
Mass Bay	DRA	MultiLIS 11.1	Alpha 1000	Single	No	Retain	In process	Yes	No	No
Middlesex	GEAC	GEAC LIBS 100 plus 2.5	Sequent at NOBLE	Shared	NOBLE	Replace in 1998	Yes	Marginally	No	No

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Current Campus Conditions

Library Management Systems

Community College	Software Vendor	Software Package	Hardware Platform	Single or Shared	Consortium	Retain, Replace, or Repair	Year 2000 Compliant	Vendor Support	Z39.50 Compliant	OPAC Web-Accessible
Mount Wachusett	C/W MARS	CARL	Tandem for maintenance and PCs for GUI interface	Shared	C/W MARS	Replace in 1.5 years	By '99	Yes	Yes	Yes
Northern Essex	DRA		Mainframe at UMass Lowell	Shared	UMass Lowell	Upgrade in '98 or '99		Yes		Yes
North Shore	GEAC	LIBS 100 Plus	UNIX	Shared	NOBLE	Replace in FY '98	Yes	Yes	Yes	No, FY '98
Quinsigamond	SIRSI	Unicorn	IBM	Single	No	No plans yet, new system	Yes	Yes	Yes	?
Roxbury	No LMS	None	None	None	No	Plan to purchase LMS system	n/a	n/a	n/a	n/a
Springfield Technical	C/W MARS	CARL	Tandem at central site	Shared	C/W MARS	Replace in 2 years	No	Yes	Yes	No

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Summary of Estimated Campus Needs

Because the majority of the colleges are partners in consortia, they are unable to upgrade their library management systems unilaterally.

- Consortium members will have to wait for their service provider to make the upgrade to a modern LMS before they will be fully compliant with the system guidelines.

Six colleges have identified a need to replace or upgrade their library management systems at this time. Campuses also were asked to prioritize between the LMS and the instructional classroom.

- Bridgewater and Roxbury indicated that the LMS is their first priority for library funding. The others want the instructional classroom funded first on their campus before funds are provided for the LMS.

Library Mgmt. Systems

College	Type	Cost Estimate
Bridgewater	Hardware/Software	267,400
Fitchburg	Hardware/Software	277,030
Bunker Hill	Hardware/Software	31,900
Quinsigamond	Hardware/Software	75,770
Roxbury	Hardware/Software	224,820
Westfield	Software	22,000
TOTAL		898,920

Detailed project descriptions are provided in the investment brief package.

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Library Task Force members identified a need for digital microform reader/printer systems at each campus.

Libraries currently rely on microform systems (microfilm and microfiche) that are not capable of transferring the information to digital format for electronic exchange.

- Demand for electronic copies of documents from microforms is increasing as faculty and students do more research work on their personal computers from their office, dorm or home. In addition, distance learners who cannot come to campus to use the current microform readers must rely on a librarian to send a printed copy of the document to them. The current technology will be inadequate to meet future demands as distance education grows and the need to electronic versions of documents increases.

The digital microform reader/printer systems will save librarians and users time and money spent to reproduce and transmit the documents.

- Currently, the electronic transmission of a microform document requires the library to print a copy and mail or fax it to the requester. The new technology gives librarians (or users) the ability to produce electronic copies of the documents that can be saved to a floppy disk or forwarded via e-mail. This is a significant improvement in service for the users, as they do not have to print the documents at the microform reader in order to have a copy. And the library saves the time and money on printing and sending the documents.

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Summary of Estimated Campus Needs

Digital microform reader/printers are needed on every campus. The Library Task Force estimated that each community college requires two systems and each state college requires three due to higher volumes of use.

- Total Number of Systems Required = 57
  - Community colleges = 2 per campus X 15 campuses = 30 systems
  - State colleges = 3 per campus X 9 campuses - 27 systems

The estimated cost of each system is $10,000. Therefore, the total cost for this project would be approximately $570,000.

- This figure possibly could be reduced by making a bulk purchase of all 57 systems from a single vendor. A collaborative purchasing project should be initiated to develop a request for proposal for digital microform reader/printers and take the next steps toward procurement and installation of the systems.

A detailed project description is provided in the investment brief package.

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Collaborative Opportunity— Virtual Library of Shared Databases

Campuses would like to see the development of a statewide "virtual library" of shared databases.

- The delivery of library services via the Web will be a standard feature for many colleges and universities throughout the country within five years, so public institutions in Massachusetts will need comparable facilities to remain academically competitive. Access to library information from anywhere at anytime is a significant enhancement in services that is an immense benefit to students and faculty.
- In light of exemplary practices in library collaboration around the country, it is imperative to adopt a vision of a comprehensive digital library for the state. Other groups, particularly the Mass. Board of Library Commissioners, are working on similar and related agendas -- the MBHE digital library projects should be coordinated with this other statewide library initiative.
- Development of a statewide virtual library will enhance educational services available to students and faculty, broaden public access to the campus library holdings, and provide library services for distance learning programs.

Efforts to create virtual libraries in other states have required support at the highest levels of education and government to succeed.

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With the long range vision of a statewide virtual library in mind, an analysis of exemplary library consortia revealed a set of opportunities for electronic collaboration such as:

Shared Databases

- Provide common access to bibliographic and citation databases, finding aids, full-text, and/or other materials mounted by or under contract of the participants (common to all profiled consortia).

Union Catalog

- A single electronic catalog of all the holdings of participant libraries (e.g., FCLA, UC System).

Automated Interlibrary Loan

- A mechanism to streamline and facilitate loaning of materials across participant libraries for patron use (e.g., OCLC, NELINET, FCLA, GALILEO, VIVA).

Common Access Point

- An index providing direct electronic access to participant library catalogs, citation indices, databases and other resources (common to all profiled consortia).

Detailed descriptions of exemplary practices for these and other collaborative options are provided in the appendices to this plan.

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Shared databases are the most promising form of collaboration, because they provide rapid educational benefits with minimal system modifications.

The state and community colleges collaborate primarily with members of their regional consortiums (outlined in the section on library management systems).

- These regional groupings provide valuable services to their members, but they also make it difficult to develop statewide electronic library systems. For example, a union catalogs like those provided by the University of California system and the Florida Center for Library Automation (FCLA) would require a complete overhaul of the library systems environment that currently exists in Massachusetts. The costs far exceed the benefits at this time.

Given this current systems environment, the most viable options are shared databases of digital materials over the World Wide Web.

- Shared databases have several advantages over the other collaborative opportunities. First, they are accessible from any networked computer with a Web browser. Second, unlike some of the other options, they do not require campuses to modify their current library management system. Third, they can be quickly implemented because they are already developed and hosted by other organizations. Finally, they provide rapid return on investment because the faculty and students can use them immediately.

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Exemplary Practices for Shared Databases

Shared databases of digital library materials provide vast new information resources that can be accessed via the World Wide Web.

- Systems in Ohio, Virginia, Florida and elsewhere have already pooled their financial and technical resources to develop shared digital library services. The earliest collaborative, developed in Ohio 30 years ago, has grown into the premier digital library services bureau called the Online Computer Library Center (OCLC). It now sells its services and digital materials to libraries throughout the world.
- Georgia's system called "Galileo" is building a "single statewide library" to provide access to shared databases. The state's public colleges and universities were the initial GALILEO clients, but K-12 and public library systems have recently joined the system.
- The governor of California recently allocated $1.0 million and requested $3.0 million more for the development of the California Digital Library to create an electronic-archiving projects on the system's nine university campuses and a central data base of electronic materials that researchers can use from their own computers. This will only be accessible to faculty and students on the nine UC campuses.

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The key benefits of system-wide shared databases include:

Access to the latest academic materials for faculty and students.

- Increasingly, library materials are available in digital shared databases. Periodicals, scientific journals, newspapers and a host of other current information resources are appearing online for easy access via the Web. For example, Encyclopedia Britannica now publishes its most current materials online to stay abreast of recent events.

Increased access to information from anywhere at anytime.

- Faculty and students using these shared databases do not have to worry if the library is open because the information is available 24 hours per day from any networked computer. They can work from their dorm room or their office to use these electronic library resources.

Economy of scale in licensing shared databases collaboratively.

- Collaborative licensing provides significant financial savings. For example, licensing the OCLC FirstSearch database service costs $98,000 for 20 simultaneous users on one campus or $193,600 for unlimited use for the entire system. In this hypothetical case, licensing one unlimited use database saves the state over $2.0 million compared to each campus acting alone to license the same database.

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Guiding principles developed by the Library Task Force for these shared databases are:

- Shared databases should be delivered by direct license from vendors (i.e., not mounted and served from a particular campus).
- Databases should be licensed cooperatively on behalf of all of the campuses and the costs paid directly by central funds rather than attempting optional participation by schools based on their interest in a particular database.
  - Corollary: Only databases of broad appeal and application across all campuses will be licensed this way. Massachusetts Conference of Chief Librarians of Public Higher Education Institutions (MCCLPHEI) has already developed a process for identifying such databases and this process should be used to identify the databases for license in this project.
- The nature of shared databases requires a continuing commitment of resources. It is important that a source of operating funds such as ERM be identified to sustain this initiative.
- Support services should be provided to manage and implement the database across all campuses and to provide ongoing support for system level issues (e.g., how to arrange IP restrictions appropriately to meet a campus' needs).

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Issues and Options

To successfully implement the shared database collaborative, four strategic issues must be addressed.

- Governance
  - A structure should be in place for making decisions such as what shared databases are licensed and what vendors are chosen to provide the services.
- Support Services
  - Technical and administrative issues invariably arise, so some form of support service is needed to keep the systems functioning properly.
- Funding
  - Licensing costs can be substantial for some of the more widely used databases, so decisions will need to be made about how to pay for these ongoing operating costs.
- Content
  - There are numerous shared databases online, ranging from general information in Britannica OnLine to specific scientific research databases. Decisions will need to be made about what content is worth licensing for all of the campuses.

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Issues and Options

Governance

- The governing body for this service will have to be empowered to evaluate service options, make content decisions on behalf of the systems users, and negotiate with vendors on behalf of the MBHE.
- These decisions should be made by persons with knowledge of the needs of the systems users. Currently, MCCLPHEI is the only organized body with that knowledge. It is composed of library representatives from each campus who can draw upon their experience with the information and their familiarity with the needs of the users.
- Oversight of the process should be provided by the MBHE staff when significant decisions such as contract approval must be reviewed and authorized by the Board.

Recommendation: Make MCCLPHEI the governing body for the shared databases with the authority to decide on content and arrange contracts with database suppliers.

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Issues and Options

Support Services

- Support services will be required to resolve both technical and administrative issues. Technical assistance is needed to ensure that the campus systems can link properly to the licensed databases via their high speed network and the Internet. Support personnel have to be in place to resolve Internet Protocol addressing and other potential problems that are bound to arise. Similarly, competent administration of the service to assign passwords, prevent security breeches, and address the concerns of users is required.
- It is best to avoid creating a new administrative organization with its associated costs to run this service. Instead, it is more desirable to build on the existing technical capabilities at one of the campuses. Campuses should be allowed to bid competitively to host the service for some remuneration. This simplifies the management of the service and minimizes organizational costs.

Recommendation: Contract with one campus as a "host institution" to provide technical support services and to administer the shared database licensing agreements.

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Issues and Options

Funding

- Funding sources for existing consortia vary from 100% state funding provided by Georgia to100% subscriber-fee based services in Ohio. The newer consortia tend to be funded centrally for a core set of databases until they become established. Then, fees are introduced for special database services that the campuses want to license, as is the case in Florida.
- The actual cost of licensing shared databases is unknown at this time because it will depend upon the content chosen. However, to provide a cost reference point, OCLC FirstSearch, one of the largest services, was selected as an example database. The cost of an unlimited user license for this database is estimated to be $200,000 annually. Support services would add to that cost.
- To start the service, two such general resource databases could be licensed for an estimated cost of $500,000 annually, including the support payment to the host institution. ERM or some other source of operational funds should be used to provide continuing support for this service.

Recommendation: Allocate an annual operating budget of $500,000 to license shared databases for all students and faculty in the Massachusetts public higher education system.

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Issues and Options

Content

- Content decisions have the potential to be contentious issues related to shared databases. Campuses will undoubtedly have different information needs due to distinct disciplinary requirements. The research faculty at the universities are likely to require access to specialized databases, while the community college faculty and students may only need access to more general education resources.
- These issues will have to be resolved by the governing body. As a guiding principle, however, only databases of broad appeal and application across all campuses will be licensed this way. MCCLPHEI has already done some work to develop a process for identifying such "common use" databases. The actual selection process should build on this process to identify the databases that are to be licensed in this pilot project.

Recommendation: During the pilot project, license only databases that have a broad appeal and usefulness across all campuses.

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Summary of Recommendations for Shared Databases

Governance

- Make MCCLPHEI the governing body for the shared databases with the authority to decide on content and negotiate contracts with database suppliers.

Support Services

- Procure support services as part of the database licensing agreement.

Funding

- Allocate an annual operating budget of $500,000 to license shared databases for all students and faculty in the Massachusetts public higher education system.

Content

- During the pilot project, only license databases that have a broad appeal and usefulness across all campuses.

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Institutions are taking many different approaches to incorporating instructional technology into the educational process. In this plan, we address three areas where there are opportunities to support the use of the technology.

Course Enhancements

Numerous faculty members are experimenting with course enhancement using Web-based materials, interactive software, and e-mail communications.

Faculty Training & Development

As instructional technology becomes more widespread, faculty will require training in its use and development so that they can apply it effectively to their courses.

Distance Education

Campuses are already developing individual programs and there is an opportunity to collaborate on distance education programs, as is being done in other states and regions.

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Course enhancement can range from setting up an e-mail list for a class to using a Web site with interactive programs to deliver course lessons.

Just as there are many forms of instructional materials for traditional courses, there are many different instructional technology tools and techniques. The following are examples of the most common ones:

Electronic Mail

- E-mail opens up an additional avenue for communication that is being used to expand the learning process. Discussion lists and "chat rooms" support new forms of interaction between the students and faculty. Nationwide, e-mail is being used in more than one-third of all courses according to the 1997 Campus Computing Survey.

Course Webpage

- The next level up in complexity is the development of a course Webpage. This can serve a range of student needs from providing information on course assignments (online syllabus) to offering interactive practice problems and laboratories for conducting simulated experiments.

Courseware

- Advanced faculty members are developing or adopting courseware specifically designed for their fields, such as Mathematica for math courses.

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Exemplary Practices in Course Enhancement

Course enhancement is generally the first step toward utilizing instructional technology. Most early adopters have used an evolutionary approach to introducing technology into the curriculum rather than attempting to make the change all at once.

- Many institutions use faculty grants to stimulate the use of technology to enhance courses. At UCLA, the teaching support center has been awarding small grants to faculty members for several years to encourage them to incorporate technology into their course materials. This has resulted in new courseware and in tools such as a "virtual office hours" program that allows faculty members to use technology to host discussions with students online.

- Johns Hopkins University also began encouraging faculty development of course tools. The engineering faculty have created a suite of online interactive learning tools that students can access at any time. Students conduct experiments online, do homework problems, and even take timed tests. These innovations have been offered in the introductory courses first, and as students progress through the program, the university is building increasingly more complex electronic tools to support their learning process.

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Current Campus Conditions

There are dozens of courses throughout the system that are incorporating electronic tools and techniques into the learning process.

- In the past few years, this has generally occurred when faculty members have experimented with instructional technology to help their students. At the Mass. College of Liberal Arts, for example, there is a small but growing pool of Web-based course materials.

- Some campuses are beginning to strengthen their use of these technologies. Bristol Community College is creating "CITE" (Center for Instructional Technology Excellence) to assist faculty with the development of multimedia course materials. Holyoke is also beginning to develop these capabilities.

- However, there is currently very little system-wide support for developing, disseminating, and monitoring these tools and techniques after they have been created. There is also little or no reward for the faculty members who invest their time in the development process. As a result, faculty can become discouraged when the technology does not work as expected, and may abandon it before any significant pedagogical gains are made.

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The benefits of these instructional technology tools and techniques are beginning to emerge as their use becomes more mainstream.

In courses requiring repetitive problem solving exercises such as engineering and statistics, instructional technology has been shown to improve student learning.

- In the Fall of 1996, a professor of statistics at CSU Northridge divided his class into two groups. One attended class as usual, listening to lectures, handing in homework assignments, and taking examinations. The other took an on-line version of the course, completing assignments on a World-Wide Web site, posting questions and comments to an electronic discussion list, and meeting with their professor in an Internet "chat room." After an orientation session, students in the virtual class went to the classroom only for their mid-term and final exams. On both tests, the professor found, the wired students outscored their traditional counterparts by an average of 20 per cent.

Faculty members have also noted increases in class participation resulting from the use of course enhancement tools.

- For example, posting lecture notes and readings online in advance of the class has reduced the amount of lecturing required and left more time for class discussions. Students can focus on the content and quality of the classroom discussion rather than trying to copy the professors notes since they are already posted online.

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Future Support for Course Enhancement

Encourage faculty to incorporate basic instructional technology tools and techniques into their courses using incentives such as grant programs.

- The Board should continue to use financial resources and incentives such as Performance Improvement Grants to help campuses develop instructional technology and increase the use of email lists, discussion sites, Websites, and other tools for their courses.
- As noted earlier, many exemplary institutions have small grant programs to stimulate faculty development activity. This type of incentive structure for promoting the use of course enhancement tools has been more successful at other colleges and universities that a mandate to use the technology with no financial support.
- Instructional technology grants can also be useful for helping campuses such as the Mass. College of Art that have specialized educational technology needs.

The Board should create a systemwide Instructional Technology Grant Program and allocate $100,000 annually for three years as a pilot program. Grant requests should be evaluated and awarded by a small committee composed of faculty members. The program should be evaluated after three years to determine if it is creating systemwide educational benefits.

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Future Support for Course Enhancement

Develop a "Courseware Clearinghouse" at a selected host campus to collect, catalog, store and disseminate developed through the courseware grant program or acquired from other institutions

- The true value of technological course enhancements is realized when they are shared with other faculty members teaching similar courses. For example, courseware for an introductory math class developed at one campus increases in value tremendously if it is shared with all of the introductory math classes in the system.
- Ideally, this Courseware Clearinghouse should be located at one of the regional Instructional Technology Centers recommended in the section of this plan on faculty training and development. The regional centers will provide a network for transmitting this knowledge to the faculty in the most effective and efficient manner.
- The estimated cost of this clearinghouse is approximately $120,000 per year—$50,000 for capital equipment and software purchases and $70,000 for one staff person to manage the data resources. This should be funded through an annual operating allocation to the host campus to cover the cost of equipment and operating costs.
- Benefits from this service include a reduction in faculty time spent developing duplicate software, improvements in learning from the use of proven courseware, and the potential to sell these products to other colleges and universities and recover some of the costs.

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Collaborative Opportunity—Faculty Training and Development

Campuses expressed an interest in collaborating to provide faculty training and development in instructional technology.

- There is a growing demand for training and support that most of the campuses are not equipped to provide. The instructional technology facilities, systems and staff are expensive to set up and maintain, and the campuses currently do not have the funding to host their own training centers.
- Collaborating on faculty training and development for instructional technology will provide valuable opportunities to share expertise and lessons learned across more campuses. Campuses want to apply the best practices in instructional technology, and the cross-fertilization of ideas and experiences that will occur in a collaborative model will greatly enhance the opportunities to do that.

Faculty training in instructional technology will be a continuous effort as new tools and techniques are developed. Sharing these activities across multiple campuses will increase the exchange of ideas and reduce costs over each campus trying to provide the same services.

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Exemplary Practices in Faculty Training and Development

Faculty training and development is a cornerstone to successfully utilizing instructional technology.

- The University of Delaware has created a training and development lab called "The PRESENT"(Practical Resources for Educators Seeking Effective New Technologies) to support faculty development. A series of week-long faculty training conferences in new technology held twice a year also has been initiated. Interested faculty members attend seminars and workshops taught by their peers on exemplary practices in the use of instructional technology. This was started two years ago and more than 25% of the faculty have been to a conference and begun applying lessons learned.
- Harvard University has created an Instructional Computing Group for supporting faculty training and development of new Web-based course materials. This organizational unit is staffed by instructional computing specialists who can help faculty find the right technology for their particular curricular needs.
- Many other institutions from the University of Connecticut to UCLA have created comparable programs to encourage faculty to use instructional technology. These institutions have found that faculty require additional support during the transition to a new pedagogy which is more reliant on technology.

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Exemplary Practices in Faculty Training and Development

Other university systems have already developed formal faculty training programs to speed up the introduction of instructional technology. The State University of New York (SUNY) has created a Training Center for technology that is part of the Office of Advanced Learning & Information Services (ALIS).

- The mission of the Center is "to facilitate the positive uses of technology in the on-going transformation of the State University of New York by ensuring that the human resources (faculty and staff) of SUNY have access to the training and professional development necessary to effectively maintain, use, support, and advance SUNY as a productive system of higher education."
- Membership is voluntary and open to all SUNY state-operated, statutory, and community colleges. The Center is governed by an Advisory Committee composed of representatives from member campuses.
- The Center is located in Syracuse and has a staff of four full time employees (soon to be expanded to nine). There are also numerous external trainers on contract. The annual budget is $500,0000. Seventy percent of the funding comes from fees paid by campuses for faculty training and 30% comes from system central funds. In addition to the fee based training, there are many free services such as the Technology Resources Library that faculty can utilize.

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Faculty training and development is crucial to its widespread adoption of instructional technologies.

Most faculty members received their pedagogical training before the advent of current instructional technologies.

- The vast majority of faculty are not familiar with the latest tools and techniques, and the learning curve is steep. This discourages many faculty members from trying to adopt them on their own.
- Early adopters of the technology have found that the time required to learn, implement, and support the tools and techniques on their own is too high to make widespread adoption possible. It is only the most motivated faculty who have succeeded.

Re-training the faculty to apply these new tools and techniques will require a long-term commitment to instructional technology.

- Inconsistent or unstructured efforts to use instructional technology often are worse than doing nothing at all because they have been shown to fail more frequently, creating frustration among the faculty. The campuses will have to develop faculty capabilities and support structures consistently over time to ensure that the efforts are not undermined by early program failures.

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However, there are significant cultural barriers to this training and the use of instructional technology.

Faculty at some institutions have been reluctant to adopt the new technology for a number of reasons.

- There is still a lot of skepticism over the usefulness and effectiveness of instructional technology. Many faculty members are reluctant to invest their time and energy in something that is unproven. More empirical studies like the one done at CSU Northridge (described in the section on Course Enhancements) are needed before teachers will be convinced of the worthiness of the technology.
- Some faculty also are concerned about being displaced by technology. They hear that online courses will eliminate the need for faculty, and they are unwilling to try educational technology methods for fear of losing their jobs. Though this clearly has not been the case at leading-edge institutions, such fear is inhibiting the adoption of the new tools and techniques.
- Finally, many faculty lack the time needed to learn how to use the technology. A concentrated effort is necessary to become familiar with instructional technology, and faculty may need to be released from other obligations if they are to successfully climb this learning curve.

Building faculty familiarity with and confidence in educational technology will be necessary to overcome these barriers and encourage its use.

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The most successful training programs are peer-based, hands-on, and readily available.

Experience at leading edge institutions shows that faculty learn about instructional technology best from their peers.

- Faculty members who have adopted the new technology have greater credibility with the other faculty than professional information technology staff who know the technology but may not understand the pedagogical issues.
- The most successful training programs have been developed as collaborations between teaching and learning centers, IT staff, and faculty who are early adopters of the technology.

Hands-on seminars create the greatest return on faculty time invested in the learning process.

- The most successful training and development programs emphasize direct contact with the hardware/software. This builds familiarity with the tools, increases faculty comfort, and often results in a tangible product for them to use in their course. Familiarity helps users gain confidence in the technology and in their ability to resolve minor problems that inevitably will occur when they are using it.

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Current Campus Conditions

A range of training and development efforts are being utilized at this time, but most are informal and ad-hoc.

- Grants are awarded from local funds or Performance Improvement Grants on some campuses for faculty training and development. Much of this effort, however, has been focused on learning how to teach effectively using two-way video systems such as PictureTel.
- Campuses are also using brown-bag lunches to exchange information on lessons learned from using instructional technology among faculty. This activity often works best at the departmental level, but rarely scales up to reach a significant number of faculty throughout the institution.
- Special seminars have also been organized to showcase instructional technology. However, as previously noted, the show-and-tell format has been demonstrated to be less effective than an interactive workshop.

These types of local activities are a good start, but more coordinated and systematic efforts will be required for technology to have a significant impact on the learning process.

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Future Support for Faculty Training and Development

Applying exemplary practices and lesson learned in other systems, the Board should create a network of regional Instructional Technology Centers to provide training and development for faculty members.

- Four geographic regions should be established—Northeast, Southeast, Central and Western. One campus in each region should be selected through a competitive proposal process to become the "host institution" for the Center.
- The total cost to set-up and operate the four sites for a three-year period is estimated to be approximately $3.2 million. The capital cost to establish each Center is estimated at $200,000, utilizing available space at the host institution. Annual operating costs are expected to be approximately $200,000 per center, including salaries, equipment replacement, and other associated costs. An initial staff of two FTE should be created to start-up each of the Centers: a director and one instructional technology specialist. Dedicated annual operating funds will need to be created to ensure continuity of the program. Fees could also be charged for special programs and advanced training for individual campuses.

Benefits include economies of scale for training programs, greater interchange of ideas among the campuses, and one-stop service for faculty seeking assistance.

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Collaborative Opportunity - Distance Education

Distance education is perceived as a growth opportunity by many institutions throughout the country. Most are operating independent programs, however there are some collaborative efforts underway.

- Collaborative institutions such as National Technological University, Western Governors University and the California Virtual University provide marketing and administrative services for their members. They create an economy of scale in the development of distance education programs, delivery systems, and student services. They also reduce competition among members, thereby providing them with more confidence that their initial investment will provide future returns.
- Within the state system, the Massachusetts Consortium of Colleges for Distance Education (MASSCODE) was created to link five campuses with high schools and community centers throughout Essex, Middlesex, and Suffolk Counties.

To be successful, these collaborative efforts must be guided by educational needs and not technological fascination. The educational mission of the campus/system must clearly articulate the purpose and benefits of providing educational services in this manner.

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Exemplary Practices in Distance Education

Distance education programs have been most successful when tailored to specific "customer" needs.

- University of Phoenix is clearly the leader in this field. They have been successful, in part, because they identified their customer's unique needs, and built their faculty, curriculum, and use of technology around them. They have specifically avoided trying to take the traditional educational approach and deliver it via electronic means.
- First, they focus on the working professional trying to obtain an advanced degree. They do not currently try to use their approach with traditional undergraduates. Second, they select, train, and organize the faculty to focus on distance learning and not research or other activities. Faculty members are chosen for professional knowledge and must be current practitioners in a field to ensure the the most practical lessons are provided to the students. Finally, they have clearly defined when the technology is beneficial and when it is not. They do not try to solve every problem with technology. Interaction with the faculty via telephone or in person is still possible if there are particular problems that require greater attention.

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Exemplary Practices in Distance Education

Some institutions are setting themselves up as "brokers" of distance education services rather than as course producers.

- Founded in 1983, National Technological University (NTU) is a consortium of 48 universities that participate in the academic graduate programs. Some institutions participate in many disciplines, while others provide courses only in selected subject matter areas. NTU contracts with these and other institutions and faculty to develop additional curricula and courses as demand warrants.
- University of Texas has developed the "World Lecture Hall," a web site where hundreds of courses from colleges and universities all over the world are compiled. This is a low maintenance way to ensure that their students (and others) have easy access to these learning resources.
- Western Governors University is a new institution designed as a clearinghouse that will compile courses from the participating colleges and universities into degree programs. It provides an administrative and marketing umbrella for these activities and sets up a new organizational structure that is more responsive to the needs of students enrolling in these programs.
- California Virtual University (CVU) has recently been created with an initial investment of $5.9 million. According to the preliminary design, CVU will host courses but will not have faculty or programs of its own. All of the responsibility for the curriculum will remain with the existing colleges and universities in California that are developing the courses.

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Distance education is already occurring within the Massachusetts system in several different forms.

Individually, there are many campus efforts to provide distance education services. A few examples include:

- Bristol, which began offering distance education courses through TV transmission 1990. In the Fall of 1995, 45 students were enrolled in five "for-credit" courses, including courses leading to a degree, at a typical cost of $246 per course.
- Bunker Hill has offered courses through TV, videocassette and correspondence materials since 1994. In the Fall semester of 1995, 175 students were enrolled at a typical cost of $246 per course.
- Cape Cod enrolled 132 students in TV and videocassette courses offered to individuals and military installations in 1995 at a typical cost of $261 per course.

Collaboratively, several campuses are already pooling their efforts in this area to develop MASSCODE.

- The consortium intends to play a role in fostering cooperation among the nascent efforts of the member campuses to provide distance education. It will pool the financial and educational resources available on the different campuses to increase the scope of their distance education efforts.

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Issues and Options

Collaboration on distance education requires careful analysis of several key areas:

- Market Demand
  - What educational and training needs are currently being underserved in the state?
- Programmatic Issues
  - What courses and degree programs should be developed?
- Delivery Strategies
  - What media should be used to deliver courses?
- Support Services
  - How will traditional on-campus service structures need to be modified to meet the needs of students studying remotely?
- Finances
  - How should distance education programs be funded?
  - What incentives are there for the campuses to collaborate?

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Issues and Options

What are the market demands for distance education?

- Currently, the approach to distance education in Massachusetts is fragmented across the campuses. Each is seeking out market niches and developing specific courses based on local capabilities. However, as the number of distance education suppliers increases, campuses are likely to come into competition for students.
- To be successful, a collaborative effort will need to identify broader market opportunities for programs that build upon the strengths of multiple campuses. For example, the collaborative could develop a "best practice" remedial education program that draws on the strengths of various faculty members on different campuses so that each institution does not have to create a program of its own. Identifying those type of opportunities will require detailed market and campus capability analyses.

Recommendation: Conduct an assessment of market demand and current distance education course offerings to determine the opportunities for program development and inter-campus collaboration.

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Issues and Options

What are the key <u>programmatic issues</u>?

- Decisions on what programs to offer now are made based on each campus' individual capabilities and systems. Frequently, this programming decision also depends upon faculty interest in developing distance education courses. However, this process is too informal to provide structured collaborative programs.
- To be successful, distance education programs need to be well structured, so that students know that they can make progress toward their degree in a timely manner. However, traditional curriculums, semesters, and other organizing structures are often not well suited for distance education. Western Governors University is setting up its programs separately from the existing higher education institutions, in part, to give it the ability to provide new, more flexible cross-institutional program options. Further development of the MASSCODE model for collaboration could encourage programmatic integration and expanded offerings for all students.

Recommendation: Coordinate distance education efforts throughout the system to minimize redundant offerings and provide coherent sets of courses and programs that integrate across multiple campuses.

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Issues and Options

What <u>delivery strategies</u> should be employed?

- Colleges and universities can employ a variety of vehicles to deliver course material to students at off-campus sites, including correspondence courses, audiocassettes, videocassettes, video-conferencing, satellite transmission, and Web-based courses. Courses can be offered either in asynchronous or synchronous formats. Asynchronous courses allow students the flexibility to engage the material at their convenience. Synchronous courses allow for students and faculty to interact in "real-time."

- Decisions on course delivery must be made on a course specific basis with the intended audience's technical proficiency and access to technology in mind. For example, continuing education courses for nurses are provided at many institutions using videotape in an asynchronous format to allow the them to fit the coursework into their varied work schedules.

Recommendation: Encourage flexibility in the choice of delivery strategy to meet the diverse needs of the students. Do not try to use the same media for every distance education program.

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Issues and Options

What <u>support services</u> will be needed?

- Faculty and administrators will need to be trained and supported to develop and deliver distance education courses. Training may include multi-media course development, pedagogical advances in distance education, and proficiency with instructional technology. This training should be provided through the Regional Instructional Technology Centers recommended in a previous section of this plan.
- Students enrolled in distance education courses require many of the services that on-campus students receive. However, experience at other institutions demonstrates that the existing on-campus processes for delivering services do not adequately meet the distinct needs and schedules of distance learners. New systems and administrative processes will be required to support them as program offerings grow.
- These training, support and administrative activities will require require systemwide coordination to be successful. A distance education "host campus" should be selected through a proposal process like that suggested for the regional training centers. The host campus should provide all of the necessary support services.

Recommendation: Develop a support service for distance education on the host campus based on a "one-stop service" model to coordinate faculty training programs and student services.

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Issues and Options

How will distance education programs be financed?

- Capital investment is required to start up distance education programs. These costs often include technical infrastructure, faculty time to develop course materials, and the initial training programs to name a few areas. In 1997, MBHE allocated approximately $1.1 million in Performance Improvement Grants to fund these types of efforts. In the future, a grant pool of at least $500,000 annually should be created to promote system-wide collaboration in program development and delivery.
- The greater cost, however, is in operating the programs. These may include broadcast facility rental, leased lines telecommunication charges, faculty salaries, and technical support staff costs. Collaboration can reduce this average cost per course by providing volume buying discounts. Over the long term, the distance education programs should be expected to pay for themselves through tuition.
- Systems are employing different strategies for funding distance education programs. Western Governors' University is providing a special pool of central funding initiate their effort. On the other hand, SUNY Empire State College, which is dedicated entirely to distance education, is treated like every other campus in the system with regards to tuition and financing.

Recommendation: Provide at least $500,000 annually to distance education efforts as a pilot program for the next three years. This should be used to provide incentives to faculty and pay for services from the host campus.

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Summary of Recommendations for Collaborative Distance Education

- Market Demand
  - Conduct an assessment of market demand and current distance education course offerings to determine the opportunities for program development and inter-campus collaboration.
- Programmatic Issues
  - Coordinate distance education efforts throughout the system to minimize redundant offerings and provide coherent sets of courses and programs that integrate across multiple campuses.
- Delivery Strategies
  - Encourage flexibility in the choice of delivery strategy to meet the diverse needs of the students. Do not try to use the same media for every distance education program.
- Support Services
  - Develop a support service for distance education on the host campus based on a "one-stop service" model to coordinate faculty training programs and student services.
- Finances
  - Provide at least $500,000 annually to distance education efforts as a pilot program for the next three years. This should be used to provide incentives to faculty and pay for services from the host campus.

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- **Administrative Systems**
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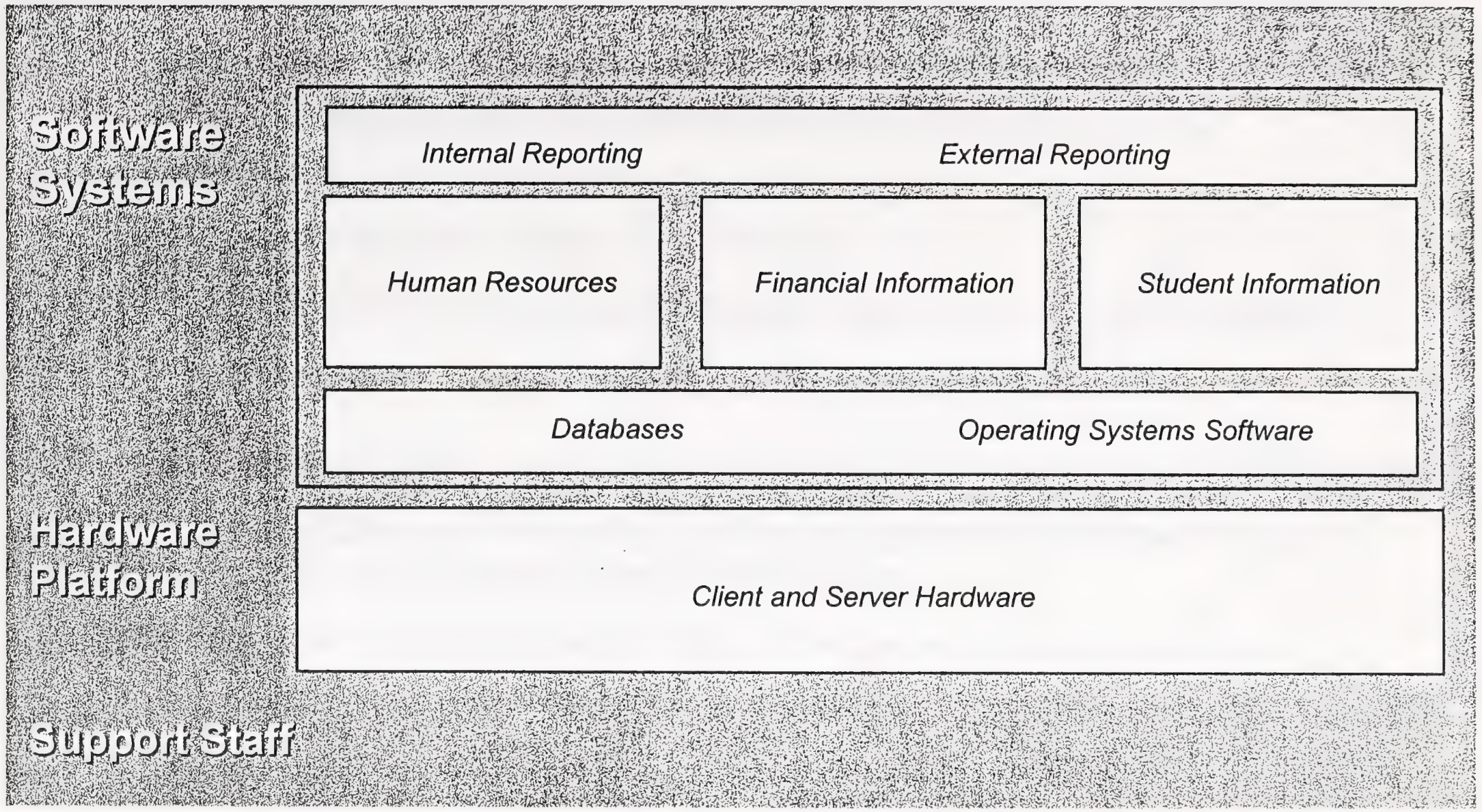
Administrative systems are dependent upon successful operations in three areas - Software, Hardware and Support Staff.



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In each area, there are key issues and required capabilities.

The software systems must provide advanced performance capabilities.

- Seamless functionality across core applications (Financial, Student, Human Resources).
- Integrated relational data base, utilizing a standard, open query language.
- Management reporting capabilities and tools.
- The ability to process correctly beyond the year 2000.

The hardware platform must be a flexible component in the system.

- Capability to expand incrementally in number of users, network connectivity, and processing power.
- No hardware imposed constraints on the capability to process dates beyond the year 2000.

The IT organization must be prepared to support the hardware and software migration to client/server technology.

- Development of new or enhanced skills in client/server architecture and tools.
- Support for more end user training and customization of the applications.
- Knowledge of package software applications in order to reengineer the administrative processes to take advantage of advanced functionality.

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Software applications for the campuses should have a set of baseline capabilities in order to be considered technically proficient.

Software systems criteria used in the evaluations done for this plan include:

- Year 2000 Compliance
- Robust Operating System
- Application Integration
- Integrated Data
- Relational Database
- Management Reporting
- Integrated Suite
- System Support
- Desktop Tool Integration

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Software Systems Criteria

Year 2000 Compliance

- The software providing administrative functionality must not impose any restrictions on operations with respect to storing, manipulating, or processing dates beyond December 31, 1999. Some functional areas such as financial aid and course registration are already being impacted by Year 2000 issues, other will be affected within the next two years.

Robust Operating System

- The operating system must be an enterprise class software that provides reliability, flexibility, scalability, and portability required for these large scale applications. During the planning horizon, preferred solutions are expected to feature client/server architectures and depend upon distributed, networked functionality.

Application Integration

- The administrative system software should utilize an integrated application strategy to heighten application consistency, standardize on software upgrades, and provide a single operational environment for all key processes. Integrated applications share not only data, but also share processes as much as possible for improved security and consistency.

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Software Systems Criteria

Integrated Data

- The administrative system software should utilize an integrated data storage strategy so that data used by many application components may be shared, thus avoiding data duplication and errors induced through non-synchronization. Integrated data storage is a key facilitator of effective distributed applications, assuring data integrity.

Relational Database

- The software providing administrative functionality should be based upon a currently standard relational database system using a standardized structured query language interface. As with other strategic software, embodiment of standards and vendor commitment and support are key factors in choosing a database solution. Relational database technology will remain the cornerstone of integrated data and application technology over the planning period.

Management Reporting

- Within the planning horizon, each institution should be able to provide management reporting and decision support technology to key decision makers. This can be accomplished through an integrated ad-hoc reporting capability or through an external on-line analytic processing tool. Both should be based on a standard relational database system. Decision support systems will be increasingly utilized to react to "what-if" scenarios and to model operational alternatives as well as to respond to ad-hoc information needs.

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Software Systems Criteria

Integrated Suite

- The software providing administrative functionality should offer a complete solution for all key processes (budget/accounting, student, human resources). Suites that deliver this functionality are recommended.

System Support

- The software providing administrative functionality must be currently supported and regularly enhanced by its provider. Software not supported or weakly supported by the vendor can be viewed as a "dead-end."

Desktop Tool Integration

- The software providing administrative functionality should be able to integrate with standard desktop productivity tools such as word processors, spreadsheets, and data base systems though mechanisms such as "cut and paste" or automated electronic interface. All users (administrative staff, executives, faculty, and students) will increasingly demand the ability to include artifacts from the administrative system, such as reports and query results, in other work products developed using workstation based productivity tools.

Collaborative purchasing of the integrated suites and system support can result in savings on capital and operating costs.

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Year 2000 compliance is a special issue that campuses must address.

Overview

- The Year 2000 problem is the inability of software applications to handle dates beyond 12/31/99. Many systems store date representations as six-digit fields—MM-DD-YY—accounting for only the month, day, and last two digits of the year. Therefore, the date July 4, 2000 gets stored in exactly the same way as July 4, 1900 (07-04-00), with the system incapable of distinguishing between the two.

Impact

- Any computer calculation using this six-digit date format will yield incorrect results. This is already leading to information processing problems in some systems such as credit card financial transactions where the card's expiration date is beyond the year 2000.

The Massachusetts Information Technology Division has conducted a survey of Year 2000 compliance issues and is monitoring campus progress toward resolving the problem.

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Institutions are faced with the decision to either fix their current applications or replace them to ensure Year 2000 compliance.

Fix current applications

- Some campuses with in-house systems have decided to pursue this option. Currently, the estimated cost to fix the software varies from $1 to $2 per line of code. This can be an expensive endeavor for complex administrative systems. However, if the application is small, this approach can be quicker and cheaper than a complete replacement. The overarching drawback to this option is that it does not allow the campus to take advantage of emerging technologies and best practices currently incorporated in the new administrative systems.

Replace the applications

- Many institutions are viewing this dilemma as an opportunity to implement new administrative systems that offer increased service and flexibility. These systems provide greater access to information for faculty, students, staff and administration; increased staff efficiency and productivity; and improved functionality. However, there is a risk of missing the Year 2000 deadline if the implementation process begins too late. Campuses should assign this a high priority if they have not begun resolving the problem yet.

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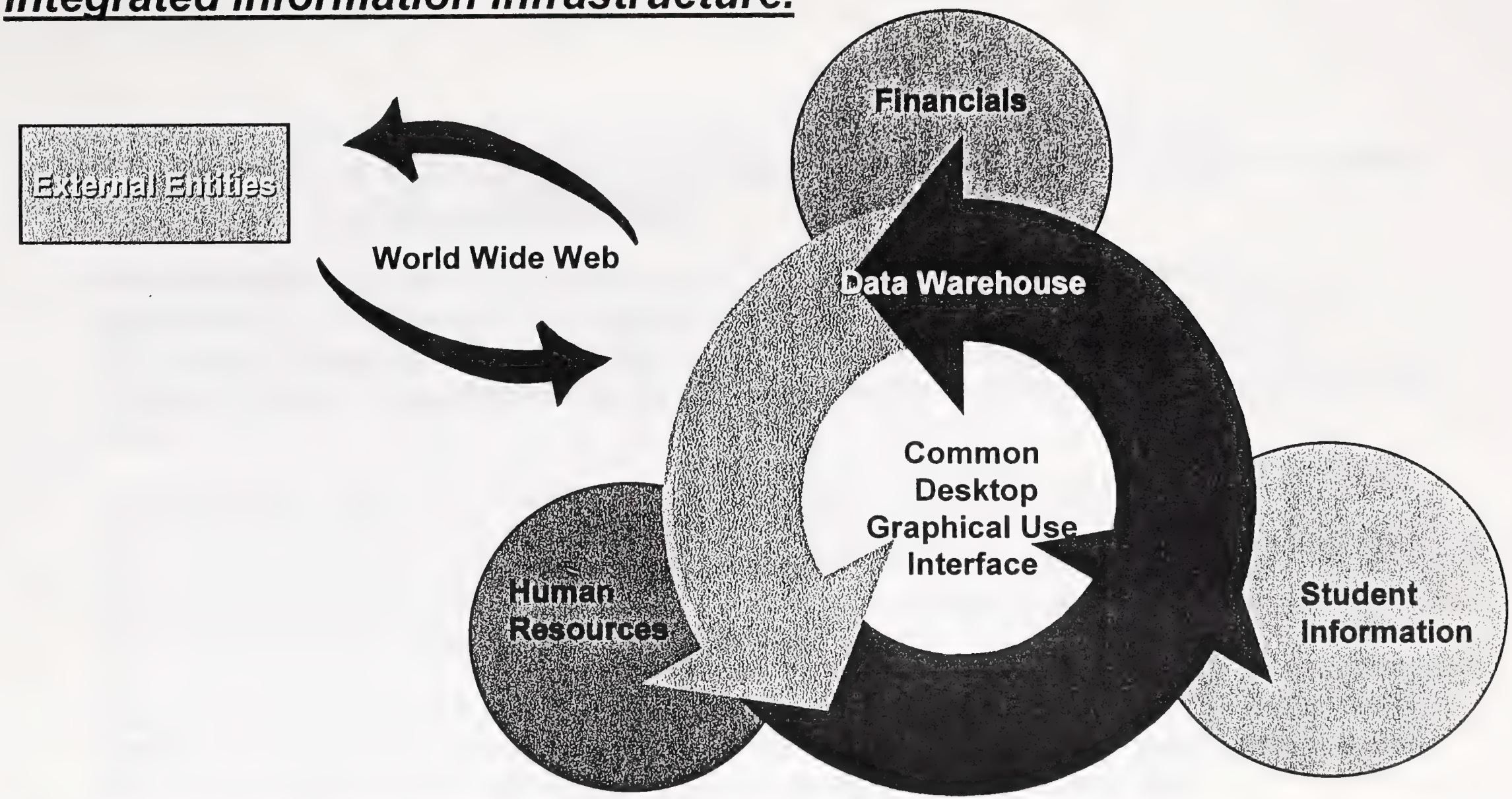
Exemplary practices for administrative systems are based upon an Integrated Information Infrastructure.



Contemporary vendor packages can provide this level of systems integration and functionality

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Exemplary Practices for Administrative Systems

Leading-edge vendors and some institutions are expanding the capabilities of their administrative systems by adding the ability to access information via the World Wide Web.

- Web enabling software will provide increased scalability, reduced hardware dependency, and increased accessibility to administrative information. This is a tremendous advantage for campuses with mixed PC and MAC environments, different network operating systems, and users working from both their home and the office.
- Leading edge institutions such as Boston College have already linked some of their administrative systems to the Web. This increases administrative efficiency by allowing users (especially students) to do more self-service information entry and retrieval. Direct access to the software results in less delay and less need for administrative staff to maintain the information.
- Student systems have been the first to go online, and hundreds of institutions are already accepting applications over the Internet. The more advanced schools are also completing course registrations and other processes via the Web.

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Guidelines based on best practices and industry standards for each of the software systems criteria are:

Software Systems

Technology Tier	Integrated Suite	System Support	Year 2000 Compliant	Operating System	Integrated Data	Application Integration	Relational Database	Management Reporting	Tool Integration
Minimal	No, only partial integration	Yes	In Process	Open proprietary	Partial	Partial	Yes, for some data	No	No
Target	Yes; data integration	Yes	Yes	Open Proprietary	Yes, for major admin functions	Yes, for major admin functions	Yes	Yes; external	Yes; with standard desktop suites
State of the Art	Yes; Full data & application integration	Yes	Yes	Open	Yes, Full; Interfaces with external systems	Yes, Full; Interfaces with external systems	Yes	Yes; integrated or external OLAP	Yes; with standard desktop suites

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Current Campus Conditions - State Colleges

Administrative Software Systems

State College	Integrated Suite	System Support	Year 2000 Compliant	Operating System	Integrated Data	Application Integration	Relational Database	Management Reporting	Tool Integration	Gap Identified	Comments
Bridgewater	SCT/IA	Yes	Vendor Commited (1)	VMS	Partial	Partial	No	No	No	**Integrated Suite**	Individual vendor product solutions in place
Fitchburg	No	Yes	Vendor Commited (1)	OpenVMS/ Unix SCO Unix	No	No	Oracle	No	No	**Integrated Suite**	Individual vendor product solutions in place
Framingham	Some In-house	Yes	No	DEC Unix	Partial	Partial	Oracle	No	No	**Integrated Suite**	Individual vendor product solutions in place
Mass. College of Art	Datatel	Yes	Vendor Commited (1)	IBM AIX	Yes	Yes	SQL Compatible	No	Partial	**Management Reporting**	Integration to desktop is "one-way" to package
Mass. College of Liberal Arts	SCT?	Yes	Vendor Commited (1)	VMS	Partial	Partial		No	No	**Integrated Suite**	None
Mass. Maritime Academy	Datatel	Yes	Vendor Commited (1)	Unix	Yes	Yes	SQL Compatible	No	Partial	**Management Reporting**	Colleague inplementation in progress; Student 1/98, HR/Fin/Pur 7/98
Salem	In-house	Yes	No	Wang OS	Partial	Partial	No	No	No	**Integrated Suite**	Financial system (Dynalogic) will be Y2K compliant; other system status mixed
Westfield	SCT/IA	Yes	Vendor Commited (1)	OpenVMS	Partial	Partial	No	No	No	**Integrated Suite**	Access RDb on PCs
Worcester	Datatel	Yes	Vendor Commited (1)	DEC Unix	Partial	Partial	SQL Compatible	No	Partial	**Management Reporting**	None

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Current Campus Conditions - Community Colleges

Administrative Software Systems

Community College	Integrated Suite	System Support	Year 2000 Compliant	Operating System	Integrated Data	Application Integration	Relational Database	Management Reporting	Tool Integration	Gap Identified	Comments
Berkshire	Datatel	Yes	Vendor Committed (1)	VMS DEC Unix	Yes	Yes	SQL Compatible	No	Partial	Management Reporting	Conversion to Colleague in progress
Bristol	SCT/Banner	Yes	Yes	DG/Ux	Partial	Yes	Oracle	No	Partial	Management Reporting	None
Bunker Hill	Datatel	Yes	Vendor Committed (1)	DG/Ux	Yes	Yes	SQL Compatible	No	Partial	Management Reporting	Conversion to Colleague in progress
Cape Cod	In-house	Yes	In-process (1)	DG/UX DG/AOS	Partial	Partial	No	No	No	Integrated suite	None
Greenfield	SCT/Banner	Yes	Yes	DG/Ux	Partial	Partial	Oracle	No	Partial	Management Reporting	None
Holyoke	SCT/IA	Yes	Vendor Committed (1)	VMS	Partial	Partial	No	No	No	Integrated suite	Currently in selection process for Admin sys & new hw (SCT/Datatel/Quodata)

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Current Campus Conditions - Community Colleges

Administrative Software Systems

Community College	Integrated Suite	System Support	Year 2000 Compliant	Operating System	Integrated Data	Application Integration	Relational Database	Management Reporting	Tool Integration	Gap Identified	Comments
Massasoit	CBSI - APECS	Yes	In-process (1)	Unisys MCP (+ NT)	Yes	Partial	DMS2 (proprietary)	No	Partial	Management Reporting	None
Mass Bay	In-house	Yes	In-process (1)	OpenVMS	Partial	Partial	Ingres	No	No	Integrated suite	None
Middlesex	SCT/IA	Yes	Vendor Committed (1)	VMS DEC Unix	Partial	Partial	Oracle	No	No	Management Reporting	Migrating to SCT/Banner & Oracle (1)
Mount Wachusett	SCT/Banner	Yes	Yes	DG/Ux	Yes	Yes	Oacle	No	Partial	Management Reporting	None
Northern Essex	In-house	Yes	In-process (1)	DG/Ux	Yes	Yes	Oracle	No	Partial	Management Reporting	Migrating to SCT/Banner & Oracle (1)
North Shore	SCT/Banner	Yes	Yes	IBM/AIX	Partial	Partial	Oracle	No	Partial	Management Reporting	None
Quinsigamond	No	No	No	Wang	Partial	Partial	No	No	No	Integrated suite	None
Roxbury	No	No		DG/AOS	No	No	No	No	No	Integrated suite	None
Springfield Technical	In-house	Yes	Yes In-process (1)	DG AOS	Partial	Partial	Infos2 (Not SQL compatible)	No	No	Integrated suite	Currently considering migration options for hardware and admin software

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The hardware platform should provide a stable and supported environment for the administrative applications. Criteria for evaluation include:

- Vendor & Support Status
  - The hardware platform for administrative systems must be a current product with full vendor support. The hardware should utilize an open architecture to minimize the impact of a vendor change. This is important because during the planning horizon, preferred solutions are expected to feature client/server architectures and depend upon distributed, networked functionality. Hardware systems that are robust, flexible, and scaleable will be required.
- Year 2000 Compliant
  - The hardware platform must not impose any restrictions on operations with respect to storing, manipulating, or processing dates beyond December 31, 1999. Internal, machine clocks must be able to operate properly into the year 2000. While most hardware systems are now compliant, this is an minimum requirement for all systems.
- Desktop Access
  - To work effectively with the newer systems, users must have desktop systems capable of operating client software and providing email and internet access. Ubiquitous desktop access to the administrative systems software will be required for future operations.

Hardware guidelines are important because software system changes affect the hardware infrastructure. Frequent software revisions by the vendor make it imperative for the campus' hardware to be able to accommodate them.

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Guidelines for the hardware platform are as follows:

Hardware Platform

Technology Tier	Vendor Support	Year 2000 Compliant	Desktop Access
Minimal	Current product; open architecture; vendor supported	In process	>50% <100%
Target	Current product; open architecture; vendor supported	Yes	100%
State of the Art	Current product; open architecture; vendor supported	Yes	100%

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Current Campus Conditions - State Colleges

Administrative Systems

Hardware Platform

State College	Vendor/Support	Year 2000 Compliant	Desktop Access	Comments
Bridgewater	DEC Vax Yes	Yes	100%	
Fitchburg	DEC Alpha Tricord Yes	Yes	100%	
Framingham	DEC Alpha Encore Yes	Yes	100%	
Mass. College of Art	IBM RS6000 Yes	Yes	45-70%	User Access
Mass. College of Liberal Arts	DEC Vax Yes	Yes	85%	User Access
Mass. Maritime Academy	486 Server	Yes	95%	Platform sufficiency; User access
Salem	Wang VS	In-process	13%	Platform sufficiency; User access
Westfield	DEC Alpha	Yes	Yes	97%	User access
Worcester	DEC Alpha	Yes	Yes	70%	User access

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Current Campus Conditions - Community Colleges

Community College	Vendor/Support	Year 2000 Compliant	Desktop Access	Comments
Berkshire	DEC Vax DEC Alpha Yes	Yes	100%	
Bristol	DG Aviion Yes	Yes	90%	User access
Bunker Hill	DG Aviion Yes	Yes	100%	
Cape Cod	DG Aviion DG Eclipse Yes	No	100%	
Greenfield	DG Yes	Yes	100%	
Holyoke	DEC Vax Yes	Yes	100%	
Massasoit	Unisys Yes	Yes	98%	Unisys processor; User access
Mass Bay	DEC Alpha	Yes	98%	Hardware unknown; User access
Middlesex	DEC Vax DEC Alpha Yes	Yes	80%	User access
Mount Wachusett	DG Aviion Yes	Yes	100%	
Northern Essex	DG Yes	No	85%	DG processor; User access
North Shore	IBM RS6000 Yes	Yes	90%	User Access
Quinsigamond	Wang	In-process	98%	Platform sufficiency; User access
Roxbury	DG MV20000 Yes DG Aviion Yes	In-process	60%	DG processor; User access
Springfield Technical	DG MV35000 Yes DG Aviion Yes	Yes	100%	DG processor

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Estimate of Financial Need - State Colleges

Based on the guidelines in this plan, State Colleges with a need for additional capital investment in administrative software, hardware or implementation services have submitted the following cost estimates.

Note that desktop computers are not included in these estimates.

Administrative Systems

State College	Type	Cost Estimate
Bridgewater	Hardware/Software/Implementation	1,870,000
Fitchburg	Hardware/Software	2,000,000
Framingham		0
Mass. College of Art	Hardware/Software/Implementation	430,350
Mass. College of Liberal Arts	Software/Implementation	516,600
Mass. Maritime Academy		0
Salem	Hardware/Software/Implementation	2,300,000
Westfield	Hardware	70,000
Worcester		0
Subtotal for State Colleges		**7,186,950**

Detailed project descriptions are provided in the investment brief package.

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Estimate of Financial Need - Community Colleges

Based on the guidelines in this plan, Community Colleges with a need for additional capital investment in administrative software, hardware or implementation services have submitted the following cost estimates.

Administrative Systems

Community College	Type	Cost Estimate
Berkshire	Hardware/Software/Implementation	560,523
Bristol		0
Bunker Hill	Software/Implementation	149,000
Cape Cod	Hardware/Software/Implementation	1,528,200
Greenfield	Software/Implementation	56,000
Holyoke	Hardware/Software/Implementation	404,800
Mass. Bay	Hardware/Software	460,870
Massasoit		0
Middlesex		0
Mount Wachusett	Hardware/Software/Implementation	53,200
Northern Essex	Hardware/Software	227,328
North Shore	Hardware	174,404
Quinsigamond	Hardware/Software	325,000
Roxbury	Software/Implementation	476,500
Springfield Technical	Hardware/Software/Implementation	795,000
Subtotal for Community Colleges		5,210,825
TOTAL FOR ALL CAMPUSES		12,397,775

Detailed project descriptions are provided in the investment brief package.

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Administrative systems support staff skills and roles are changing as integrated package applications are implemented.

These new technologies add complexity to the administrative systems.

- Knowledge of client/server architecture, relational databases, network systems, etc. will be needed in addition to specific programming languages. There will be more systems interfaces, increased data relationships, and more reliance on distributed network computing. This means that support staff will need detailed knowledge of more systems, software and hardware in the future.

Most institutions are in the process of making this change, but it has proven to be difficult to train and retain qualified staff.

- Campuses are sending staff to advanced training in the specific administrative packages, using external consultants, and offering on-campus staff training programs. However, competition for staff in the marketplace is making it very difficult to retain these personnel. Some campuses have discussed the possibility of sharing expert staff to gain access to the necessary skills within the salary limitations of the public sector pay scales.

It is especially difficult to develop staff skills due to the rapid pace of change in technology. Campuses will need to make an effort to continuously train staff to ensure that the necessary skills are available.

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Campuses will need to develop a strategy to ensure that qualified staff are available to meet campus needs.

The process for developing the key competencies among the staff can be divided into three phases.

I. Inventory current skill sets

- The campus must assess what their staff know and what level of expertise exists in the fundamental technologies used in modern packages.

II. Identify skill deficiencies.

- The gap between the current staff skills and future requirements will indicate where additional staff hiring or training will need to occur.

III. Create a plan of action for acquiring the necessary skills.

- A concrete staffing plan will provide the staff with a clear idea of career development milestones and ensure that the campus has adequate skills to resolve technical problems.

Each campus must assess its preparedness and develop a program to ensure adequate staffing with the necessary skills.

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I. Inventory the administrative systems IT staff's current skills and varying levels of expertise.

This process often yields insightful information as organizations realize the extent of staff deficiencies or the unexpected existence of more capabilities and knowledge than anticipated.

The proliferation of software packages for administrative systems require staff with a wide range of experience including:

- Desktop (including applications, graphical user interfaces, and configuration),
- Middleware (including communication protocols and remote procedure handling),
- Network (including protocols, e-mail systems, routers, NOSs, recovery and security issues), and
- Server experience (including systems management, database, and infrastructure architecture).

The following pages provide samples of some of the types of skills that will be required to meet future user and technological demands.

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Sample Support Skills

PC Specialists

- Responsible for network PC setup, configuration, and troubleshooting. Experience with PC operating systems such as DOS, Windows 3.X and Windows 95; application suites such as Lotus, Microsoft and WordPerfect; remote access software; and other organization-specific software. Average salary: $31,000

Network Engineers

- Responsible for complex network configuration issues including architecture, protocols (IP, IPX, etc.), e-mail systems setup and maintenance, and routing issues. Experience with Network Operation Systems (NOS) such as NetWare, Windows NT, and Unix; e-mail systems such as Notes, Exchange, Eudora; topologies such as Bus, Ethernet, Star; backbone technology such as Ethernet, FDDI, and ATM; servers including hardware and software installation, configuration, and troubleshooting; and Internet and intranet technologies. Average salary: $ 76,400

Salary levels given in this section are averages based on a nationwide survey of IT professionals conducted by Computerworld magazine in 1997. Coopers & Lybrand makes no claim as to their accuracy for an individual institution. Actual salaries may vary widely depending on factors such as working environment, location, benefits and other factors.

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Sample Support Skills

Database Administrator

- Responsible for the institution's data. Experience with a relational database such as DB/2 Oracle, Sybase, Informix; database maintenance activities; and data modeling. Average salary: $50,200

Network Administrators

- Manage the day-to-day network operations. This includes establishing access, monitoring performance, backup, and establishing policies and procedures. Experience with Network Operation Systems (NOS) such as NetWare, Windows NT, or Unix; PC and network management systems such as SMS, OpenView, SunNet, NetView, and NTManage. Average salary: $41,900

Systems Programmers

- Will have primary programming responsibility for system maintenance and development. Experience should include proficiency in programming languages such as COBOL, Visual Basic, C, C++, Powerbuilder, etc. In addition, experience should include exposure to enterprise-wide solutions such as PeopleSoft, Datatel, SCT, etc. Average salary: $42,300

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Sample Support Skills

Systems Analysts

- Ensure that system maintenance, modifications and development meet user requirements. Experience should include working knowledge of enterprise-wide solutions such as PeopleSoft, Datatel, SCT, etc. as well as programming languages such as COBOL, Visual Basic, C, C++, Powerbuilder, etc. Average salary: $46,800

Enterprise Architecture Specialists

- Responsible for technology integration. Experience required includes knowledge of emerging technologies including object-oriented development, and client/server architecture including PCs, server hardware and software, middleware, and mainframes. Average salary: $56,100

The demand for these skills depends upon the systems in use on the campus. Not every college will need personnel with these skills. External consultants and inter-campus collaborations to share expertise can be effective ways to ensure that the skills are available.

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II. Identify skill deficiencies for administrative systems IT staff.

Campuses should compare their current administrative systems skills with the positions and sample skills outlined in this plan.

- Use the sample skills for those positions as a guide for identifying the type of skills which are required to meet current and future user and technology expectations. The resulting deficiencies should be noted and a plan should be developed to obtain the required skills.

To address identified deficiencies, institutions may have to perform functional realignments, implement formal training plans, and create long-term staff development programs.

- Exemplary institutions have implemented mandatory training requirements, offered skill development pay bonuses, and partnered with other institutions to share expert staff. For example, University of New Mexico has a mandatory two week training and orientation program for all IT staff to ensure a minimum level of competency in a number of areas. Other colleges and universities allow employees to do consulting for profit to other organizations on their vacation time in order to develop their awareness of what others are doing and keep their skills sharp.

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III. Management must create and implement a plan of action to obtain the necessary administrative systems IT staff skills.

The organization can approach the acquisition of the necessary skills in several ways:

- Train current staff;
- Recruit external resources;
- Hire consultants (on an as needed basis); or
- Share resources between campuses.

Some campuses are already discussing the possibility of shared staff for highly technical positions.

- This type of shared staffing is already being done in the facilities departments where physical plant engineers are serving multiple campuses. Collaborative staffing is one way to retain skilled staff who command salaries that a single campus cannot afford to pay.

Each campus should develop its staffing plan based on a careful assessment of future technical needs and current staff capabilities.

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Collaborative Opportunity - Shared Services

Shared administrative systems services provide opportunities to deliver more efficient and effective operations. Campuses have expressed interest in adopting collaborative practices that could improve services and reduce their costs.

- The opportunities for collaboration range from joint purchasing agreements through centralized full service administrative processing. Savings from increased economies of scale are possible at each level, resulting in significant savings for the participating campuses.
- Campuses are motivated to collaborate for several reasons. One is the escalating cost of technology as software and hardware increase in complexity. The other is a growing shortage of qualified technical staff and the accompanying pressure to increase salaries for those who remain.
- However, collaboration requires financial support and dedication to succeed, so it is very difficult for a campus to initiate the effort. Leadership and motivation to collaborate must be strong enough to bridge the initial gaps between the campuses and get the effort started.

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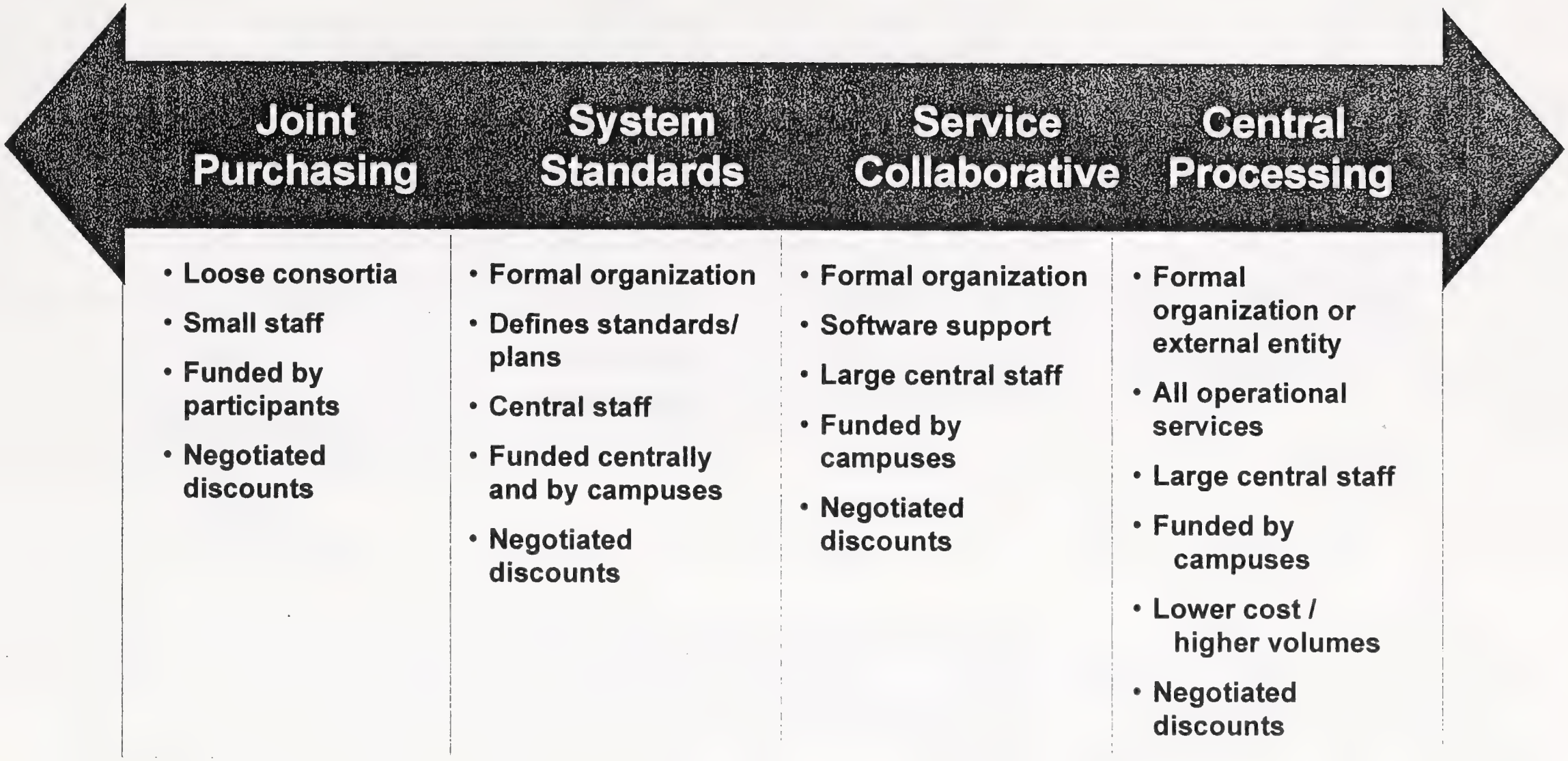
Opportunities for collaboration can take many forms. The "best" option may depend upon a particular college's need, technical maturity, and synergy with other schools.

There are a spectrum of collaborative options available.



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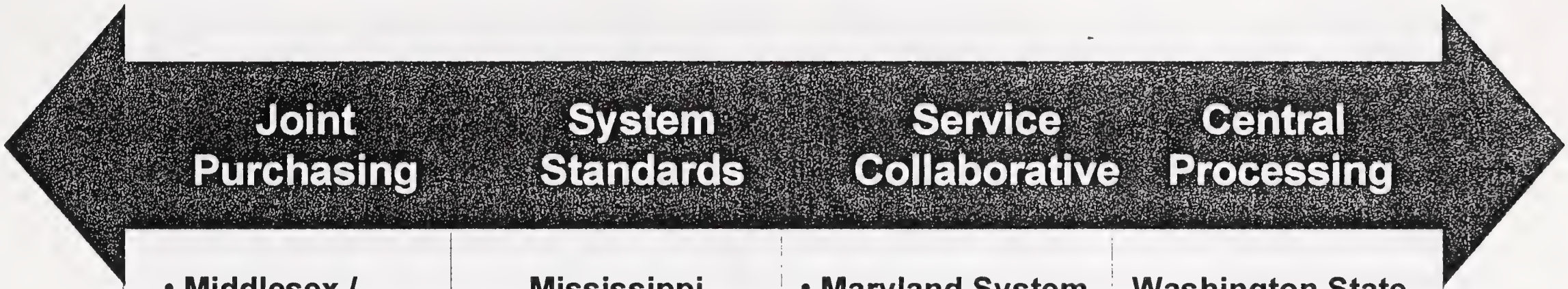
Exemplary Practices

Exemplary practices exist in each of the collaborative options.



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Exemplary Practices - Joint Purchasing

Northern Essex and Middlesex Community Colleges

- A good example of informal collaboration is that of Northern Essex and Middlesex Community Colleges. By arranging a joint purchase of an administrative software package from the same vendor, they saved 50% of the cost of individual purchases.

The Wisconsin Community College Consortium

- This is a more formal joint purchasing collaborative staffed by a director and an administrative support person who facilitate the participation of members and work with vendors to negotiate discounts. Most discounts are negotiated on high volume desktop products (some used in instruction) and can be quite significant. The consortium is beginning to work towards the selection of administrative software. The consortium is funded by the participating campuses.

Campuses are collaborating on joint purchases in a number of other areas such as facilities, but the effort required to successfully do so in administrative systems has proved to be daunting.

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Exemplary Practices - System Standards

The Mississippi Council for Education Technology (CET)

- This organization serves as the advisory group which has responsibility of setting system-wide technical standards through the Mississippi Master Plan for Educational Technology. Membership in the Council includes representatives from public education as well as private business and industry.
- The organization has one paid staff person and an annual budget of approximately $3.0 million to disburse to campuses engaged in collaborative activities. They are also responsible for building a funding model that will be used to determine the amount of money that should be spent on information technology at each campus.

There is very little support for shared standards among the campuses. The history of independent administrative systems has created a fragmented structure that would be difficult and costly to standardize.

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Exemplary Practices - Service Collaborative

The State University of New York - Student Information and Campus Administrative System (SICAS)

- This organization provide services for administrative software procurement, upgrades, implementations and support. SICAS grew out of a standardization and collective purchasing initiative for a student information system that included hardware platforms, administrative software, and operational database software.
- SICAS serves 14 of 32 state and technical colleges using a common student software platform (SCT Banner). It's budget is approximately $500,000, and it is funded by proportional allocation of membership dues. Campuses can join the collaboration by paying "back dues."
- Participants receive a significant discount on maintenance by agreeing to use SICAS for central support instead of directly contacting the vendor. SICAS also supports local modifications and interfaces specific to the SUNY system.

This model has potential application in the Massachusetts system where there is already some commonality of hardware and software systems.

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Exemplary Practices - Service Collaborative

Maryland System Services Center

- This groups services six state colleges and universities. Services provided include contract negotiation and administration, coordination of mission critical applications, product research and evaluation, release control, beta test, and end user support. In addition, the center provides support for DEC mainframes and servers, SCT/IA software, in-house data warehouse facilities, and web-based applications accessing legacy data. The administrative applications include finance, human resources, and student systems.

- The Center's operational budget is approximately $2.8 million and is funded by proportional allocation from each institutional customer. It is organized as an independent not-for-profit cooperative with a staff of approximately 25 FTE. The center reports to a board composed of Vice Presidents from the participating institutions.

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Exemplary Practices - Central Processing

The Washington State Communications Technology Center (CTC)

- This is a legal sub-entity of the State of Washington and provides technology services to the state's thirty-three colleges and two universities. Founded in 1983, CTC plans, develops or acquires, installs and supports administrative software applications. It operates as an independent service provider with half of its budget of $10 million funded centrally by the state and the other half coming from enrollment based chargebacks to campuses.
- Currently, applications are a combination of in-house and SCT packaged system software operating on an all HP hardware infrastructure. CTC is seeking funding ($5-7M) to replace hardware and software in order to move to an integrated suite approach. Institutional customers estimate that they save as much as 30% of the cost of delivering these services to their campus by using the CTC collaborative buying power and economies of scale.

This is not considered a viable collaborative model for Massachusetts at this time, because it would require a costly investment in the centralization of the administrative systems and the creation of an organization to run them.

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From this spectrum of collaborative options, campuses expressed interest in pursuing the following opportunities.

Joint Purchasing

- There could be an increase in the hardware and software purchasing efforts to achieve economies of scale.

Shared Support Staff

- This collaborative effort would involve sharing support staff across campuses. For example, two campuses sharing a database administrator. Similar sharing occurs today between campuses for a facilities engineer.

Service Collaboration

- Campuses want to share in the purchase of contract services. For example, five campuses could sharing a maintenance contract for a common administrative software package.

Informal efforts have existed in these areas in the past, but no systemwide collaboration has been developed.

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Issues and Options

Four strategic issues must be addressed to successfully implement shared services.

- Governance
  - A structure is needed for making decisions on collaborative opportunities such as vendor selection, and resource allocation.
- Services
  - Technical and administrative staff are needed to support the activities.
- Funding
  - A funding process for paying for the costs for collaborative activities such as direct labor, external services, and activity administration must be implemented.
- Migration Path
  - The development of a process where maximization of collaborative effort allows campuses to take advantage of economies achieved through synchronized implementation plans is needed.

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Issues and Options

Governance

- The governing body for this service will have to be empowered to evaluate collaborative options, make product and service decisions, and negotiate with the vendors on behalf of the campuses. An existing systemwide information technology organization such as the Coordinators of Information Technology in Education (CITE) could form the governing board, or the board could be appointed by the MBHE.
- Exemplary practices in other systems all place the governance responsibility in the hands of those participating in the collaboration. This creates a sense of ownership and responsibility among the membership.

Recommendation: Authorize CITE to define the specific organizational and governance roles and responsibilities needed to support shared services and develop a charter for implementing the collaborative program.

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Issues and Options

Services

There are two models for the system to consider.

- Loose cooperative model to provide joint purchasing and facilitate shared staffing. This would be staffed by ad-hoc resources that have other "home campus" commitments.
  - Advantages: Inexpensive, No formal bureaucracy.
  - Disadvantages: Impractical for complex issues, no continuity of effort, difficult to coordinate over large geographic areas.
- Formal service collaborative staffed with dedicated resources, funded and managed by the participating campuses.
  - Advantages: Well-defined service capabilities, clear management, service components need not be co-located, dedicated resource in addition to on-campus staff
  - Disadvantages: Requires establishment and funding of formal organization, Need to define clear ownership and direction.

Recommendation: Encourage the creation of formal IT service collaboratives. For example, campuses using SCT Banner could create, govern and fund a service group.

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Issues and Options

Funding

- Sources for funding collaborative efforts will need to be identified and allocated prior to any agreement on opportunities. These funds could be collected from participant fees and/or provided by a special allocation in the central budget.
- The service collaboratives cited as exemplary practices all have relied on campus fees to provide a significant portion of their budget. However, there may be a need to capitalize the operation. The initial funds will need to be available to ensure the ability to take advantage of opportunities that require an investment in hardware or software. Given the current availability of bond funding, the Board should consider using those funds to require collaboration between the campuses on administrative systems such as joint purchasing. The governing body in the collaborative should have oversight for funding issues.

Recommendation: Operating costs of the service collaboratives should be funded by the participating members. The Board should provide funds for initial capitalization to promote the the collaborative purchase of software and hardware.

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Issues and Options

Migration Path

- With many different campuses on different timelines for the implementation of administrative software, development of a migration path is needed to arrive at a point when the shared services can be utilized equally by all participants.
- As a first step, an administrative systems information joint purchasing strategy should be developed. Working with the documentation prepared for this plan, staff at the Board should facilitate this process and seek out opportunities to save on library management and administrative systems purchases through collaboration. More formal service collaboratives can then be developed when the campuses have implemented their systems and are in a maintenance and upgrade mode.

Recommendation: A collaborative with representatives from MBHE and each of the colleges procuring new systems should be formed to begin coordinating their investments in administrative software applications.

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Summary of Recommendations for Shared Services

Governance

- Authorize CITE to define the specific organizational and governance roles and responsibilities needed to support shared services and develop a charter for implementing the collaborative program.

Services

- Encourage the creation of formal IT service collaboratives. For example, campuses using SCT Banner could create, govern and fund a service group.

Funding

- Operating costs of the service collaboratives should be funded by the participating members. The Board should provide funds for initial capitalization to promote the the collaborative purchase of software and hardware.

Migration Path

- A collaborative with representatives from MBHE and each of the colleges procuring new systems should be formed to begin coordinating their investments in administrative software applications.

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- Introduction and Overview
- Network Connectivity
- Library Technology
- Instructional Technology
- Administrative Systems
- **Recommended Next Steps**

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To reach the target levels for technical proficiency in these areas, the Board of Higher Education should adopt a two-pronged strategy.

First, make needed capital investments in the four identified areas to build the systems necessary to support improved educational and administrative performance.

- Like the telephone system, a computer network must be ubiquitous to be of greatest value. The usefulness of the investment in technology grows dramatically as the number of network connections expands, because each new connection provides all users with access to additional information.

Second, the Board should call on campuses to allocate campus funds to support the implementation and operation of these complex systems and to assess any remaining need for increased operating funds.

- Studies have shown that more than 75% of technology costs are attributable to training, maintenance, and support activities. These are operating costs that campuses need to allocate to support the new systems. The value of the capital investment will be reduced if the necessary support services are not available on the campuses.

- While the scope of this study, which focused on capital and collaborative needs, did not assess the need for additional campus operating funds, it is clear that campuses may be struggling to maintain service capabilities. As part of future campus planning efforts, each institution should document its operational staffing needs and discuss what combination of reallocation of existing resources and new funding requests will meet the documented needs.

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Specifically, it is recommended that the Board complete the following steps:

Seek full release of the $18 million Educational Technology bond.

- Use this money to fund the capital expenditures recommended in this plan. Request funding for the remaining $11 - 12 million needed to support the completion of identified projects not fully funded by existing resources.

Develop a funding strategy for providing enhanced operational support for technology on the campuses.

- Base budgets for the campuses should be evaluated to determine if they are adequate to support the increased costs associated with introducing technology into the learning and administrative processes.

Develop a funding strategy to provide continuing support for multi-campus collaborative opportunities.

- These funds should be used to meet needs for licensing digital library materials, providing instructional technology training and development activities, and encouraging shared administrative services. This could be accomplished using an annually funded, central reserve budget to promote collaboration.

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- **Checklist for an RFP to Outsource Remote Access**
- Examples of Electronic Library Consortia

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Checklist for an RFP to Outsource Remote Access

Services from the Vendor's Server

- **Speed/Bandwidth**

  Specify the modem speed capable of being supported by the host:

  ___56 kbps

  ___33.6 kbps

  ___28.8 kbps

- **Busy Signals**

  Specify the grade of service desired (and cost):

Response	**Cost**
___P.00 (no busy signals)	_____
___P.05 (busy signals on 5 percent of calls)	_____
___Other:	_____

- **Scope of Access**

  Specify the telephone charges required for the following connections:

Point of Call	**Cost**
From institution city or town	_____
From surrounding metropolitan area	_____
U.S. connections from beyond current area code	_____
International connections	_____

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Checklist for an RFP to Outsource Remote Access

Vendor's Customer Services

- **Implementation Period for Contract**

  ___30 days

  ___45 days

  ___60 days

  ___Other:

- **Guaranteed success rate for software installation**

  ___N.A.

  ___75 percent

  ___90 percent

  ___Other:

- **Vendor's documentation**

  Content. *Check all that apply:*

  ___Software installation guide

  ___Trouble-shooting guide

  ___Vendor help-desk information

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Checklist for an RFP to Outsource Remote Access

Vendor's Customer Services

- **Vendor's documentation (continued)**

  Availability. *Check all that apply:*

  ___from vendor by surface mail

  ___from institution

  ___via World Wide Web

- **Vendor's help-desk coverage**

  Hours per day Specified days per week Weeks per year

- **Pricing Options**

  Start-up: *Specify any costs and conditions.*

  Stop-out: *Specify any costs and conditions.*

  Usage time and costs per month

  Unlimited use:

  Base costs: (number of hours) (incremental costs per hour)

  Tiering options for off-peak use: *Specify options and prices.*

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Checklist for an RFP to Outsource Remote Access

Institution Systems and Service

- **Current Systems**

  Modem pool:

  ___Retain ___Discontinue

  Electronic mail and Internet access:

  ___Retain ___Discontinue

- **Security**

  ___Collaboration with security professionals: *Specify*

  ___Consistency with institutions structures and policies:

  ___simultaneous logins

  ___passwords

  ___other:

  ___Auditing of access privileges and user transactions

  ___Non-disclosure clause about institutional security and privacy procedures

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Checklist for an RFP to Outsource Remote Access

Institution Systems and Service

- **Management**

Location of vendor's servers and maintenance

___on campus ___off campus

Reports requested of vendor:

Kinds	Frequency	Format
___Utilization reports	_____	_____
___Sign-up rates	_____	_____
___Time-of-day usage statistics	_____	_____
___Lists of complaints and resolutions	_____	_____
___Statistics on blocked calls	_____	_____
___Other:	_____	_____

- **Marketing**

Access to addresses:

___students ___faculty ___administrators ___staff

Permissions/safeguards regarding institutional logos and trademarks. *Specify.*

Billing mechanisms. *Check all that apply:*

___Direct billing to customers only

___Full and partial billing to institutional departments

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- Checklist for an RFP to Outsource Remote Access
- **Examples of Electronic Library Consortia**

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Areas of Collaboration

This document explores collaboration models among higher education libraries that might provide useful examples, either in whole or part, to the libraries of the Massachusetts Board of Higher Education (MBHE). It includes an overview section and profiles of seven library consortia. The overview section identifies the areas of cooperation illustrated by one or more of the models and then categorizes the range and progression of organization models represented.

The models illustrate cooperation in one or several of the following areas, listed in rough order of increasing difficulty or complexity:

Common Access Point, an index providing direct electronic access to participant library catalogs, citation indices, databases and other resources (common to all profiled consortia).

Shared Standards, common standards or models for patron or staff equipment, software, configuration and so on (some level common to all profiled consortia).

Buying Cooperative, the collective purchasing of equipment, licensing of materials, access to third party databases and so on (common to all profiled consortia).

Shared Support services, access to staff or patron training materials or services, shared technical support and so on (some level common to all profiled consortia).

Outreach, participation by K-12 and/or public libraries as well as higher education (e.g., NELINET, GALILIEO)

Interlibrary Loan, automated mechanisms to streamline and facilitate loaning of materials across participant libraries for patron use (e.g., OCLC, NELINET, FCLA, GALILEO, VIVA).

Shared Databases, common access to bibliographic and citation databases, finding aids, full-text, and/or other materials mounted by or under contract of the participants (common to all profiled consortia).

State Services, state history, archive and/or economic development activities (e.g., GALILEIO, VIVA).

Union Catalog, a single electronic catalog of all the holdings of participant libraries (e.g., FCLA, UC System).

Common Library Management, centrally provided or common library management system across a set of libraries (e.g., FCLA).

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Organizational Characteristics of the Consortia

In providing these services, the cooperative organizations fall in one of three general organizational models, characterized in rough order of organizational formality.

- **Collaborative Consortium**
- **Independent Consortium**
- **Service Bureau**

VIVA was the only profiled *Collaborative Consortium*, a loosely structured membership organization with little if any staff or local services. The primary function is to save money or improve service by providing a Buying Cooperative to achieve discounted rates on database and research access. Recently, VIVA has added a one-person central staff that is moving it toward a more structured organization. with campus support and funding from any other participating libraries. The University system is spending $1 million this year to start the library and wants $3 million next year to support it.

The bulk of the profiled organizations are *Independent Consortia*, formally structured organizations with a formal mission, central staff, and significant funding, both central and usually membership dues and fees. The simplest mission is to provide improved efficiency, quality, range or cost of library services or to provide specialized state services (e.g., NYCRL, GALILEO). The most ambitious mission is typically a statewide "virtual library" (GALILEO, UC System). Independent Consortia provide 'buying cooperative' services and also a range of locally mounted and supported production services. Some or all services are optional to members. Recognizing that different campuses have different priorities and needs, they require the optional services to be financed by separate service agreements and fees. This means that not all members offer all services. These consortia generally build upon a history of close working relationships (NELINET, UC system) and/or they are operating under a mandate from the state legislature (FCLA, GALILEO).

OCLC might be best characterized as a *Service Bureau*, a formal organization whose purpose is primarily to provide production library services at cost to interested buyers. It incorporates no particular goals or mission beyond the most efficient provision of its services. OCLC is the only service bureau among the profiled consortia.

Evolution of Library Consortia Models

A majority of the profiled consortia started with some level of volunteer organization aimed primarily at providing 'buying cooperative' types of services and then grew into more formal organizations with expanding services. The majority of these organizations are now independent consortia with central staff and budget, membership criteria and dues, and production services in addition to a buying cooperative. OCLC essentially traveled from a collaborative consortium to an independent organization and then to a service bureau.

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Preliminary Observations

Whatever models or services might be appropriate for collaboration among MBHE libraries, it makes the most sense to begin with a pilot program and add more complex services after initial success is demonstrated. The other consortia have used this type of evolutionary approach to build strong and reliable services.

Operationally, the ambitions of a library consortium (its mission and goals) clearly define the formality of the structure and scale of the organization. The most ambitious organizations, those seeking to create a statewide virtual library, have strong organizations either because of long experience (e.g., UC System) or strong central guidance (e.g., GALILEO). The less structured organizations generally have much less ambitious mission and goals. The MBHE will need to determine what level of collaboration will occur and what support structures (organizational, technical, financial, etc.) are require to make the endeavor successful.

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Consortium Profiles

Profile information is gathered from a review of published materials and a phone interview with staff for each consortium.

OCLC

Overview: OCLC was founded in 1967 by the presidents of Ohio colleges and universities as the "Ohio College Library Center" to maintain and operate a computerized library network, to promote the evolution of libraries and to improve and increase library services and access while reducing costs. Ten years later, OCLC had expanded its role to become an international library service organization. As the OCLC Online Computer Library Organization, OCLC now provides production services to libraries across the country and around the world. A separate state library consortium, OhioNet, was created to support OCLC services within Ohio and to continue library collaborations for the state of Ohio.

Union Catalog, a single electronic catalog of all the holdings of participant libraries (e.g., FCLA, UC System).

Common Library Management, centrally provided or common library management system across a set of libraries (e.g., FCLA).

Organizational Characteristics of the Consortia

In providing these services, the cooperative organizations fall in one of three general organizational models, characterized in rough order of organizational formality.

Collaborative Consortium

Independent Consortium

Service Bureau

VIVA was the only profiled *Collaborative Consortium*, a loosely structured membership organization with little if any staff or local services. The primary function is to save money or improve service by providing a Buying Cooperative to achieve discounted rates on database and research access. Recently, VIVA has added a one-person central staff that is moving it toward a more structured organization.

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OCLC (Continued)

Services: OCLC is the world's premier library service bureau, providing a comprehensive range of library services, described at a high level by the following overview from the Web site at **http://www.oclc.org/oclc/promo/4968ocgl/4968.htm**, "Access to the World's Information" as of Nov. 2, 1997:

WorldCat (the OCLC Online Union Catalog). The world's largest and most comprehensive bibliographic database. Libraries use the WorldCat™ database and OCLC's computerized telecommunications network to process materials and share information.

The OCLC system. Extensive online cataloging, interlibrary loan, union list, and selection services.

OCLC FirstSearch® and OCLC EPIC® services. Online reference services that provide flexible searching and subject access to over 60 databases for both library staff and end users.

OCLC FirstSearch Electronic Collections Online service. Provides remote access to large collections of journals through the Web.

OCLC Access Services. Telecommunications and standalone systems that facilitate online and offline cataloging, resource sharing, reference, and selection services.

Each of these areas include a broad set of services aimed at facilitating library cooperation (e.g., cataloging via WorldCat and related resources). They also provide technical services and standards for libraries (e.g., interlibrary loan services, telecommunications services), professional development for librarians (e.g., conferences and extensive documentation and training services). Finally, they do direct delivery of services to patrons (e.g., FirstSearch and EPIC).

Organization and Governance: Serving more than 370 libraries, OCLC is an independent non-profit consortium governed by a 12 Member Board of Trustees, a Users Council and a set of Advisory Committees on each of its major service areas. OCLC has extensive professional staff and production facilities.

Funding: OCLC is fully supported by service fees.

Membership: Organizations which participate in the OCLC system, including cataloging services, qualify as General Members and are eligible participate in and vote for the Users Council and related committees. OCLC services are available to member and non-member organizations. In the United States, OCLC services are generally consolidated, represented and supported by state or regional library consortia such as NELINET, profiled below.

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OCLC (Continued)

Comments: According to staff, OCLC's strategic plan is:

To integrate and enhance OCLC core services by providing easy and seamless access to information;

To innovate by providing new, cost-effective, electronic alternatives such as archiving and new telecommunications technologies;

To internationalize by increasing global coverage and perspective; and

To inform by adding educational services for the library and education communities (OCLC Institute).

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New England Library Network (NELINET)

Overview: NELINET was created to provide packaging discounts and support for OCLC services within the New England region. It has now expanded to offer services beyond OCLC such as document delivery services and group purchase arrangements for library supplies and equipment.

Services:

Support and access to OCLC services

Training and education, e.g., in Internet searching and technology skills;

Discounted group purchasing, e.g., for computer equipment and software, library supplies;

Discounted document delivery services from four specialty libraries;

Discounted access with no minimum to four major online services (e.g., OVID, DIALOG, WILSONLINE); and

Discounted subscriptions to a set of CD-ROM library databases.

NELINET is considering adding networking and related technology services.

Organization and Governance: NELINET is a member-owned, member-governed non-profit cooperative of more than 500 academic, public, and special libraries in the six New England states. A member elected Board of Directors governs overall, while a set of advisory committees guide service areas. 22 professional staff deliver NELINET services.

Funding: NELINET is fully funded through membership dues, commissions on OCLC service sales and service fees.

Nelinet receives 100% of its funding from member libraries in membership and service fees. Its total budget is $1,522,000, with $708,500 paying for OCLC services. Nelinet has 23 staff members.

With 1,184 accounts in six states (and the potential for one account to be a consortia with 10 or 12 libraries or serving non-members who just buy databases) there is no way to calculate the number of end users.

Membership: NELINET supports six categories of membership based on level of organizational participation and volume of services. Categories are: Voting Members, Nonvoting Members, Additional Symbol Members, Affiliate Members, Resource Sharing Only Participants, and Reference Only Participants.

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Florida Center for Library Automation (FCLA)

Overview: An agency of the Florida state university system, the FCLA is centrally funded to provide core system library automation functions. Note that Florida community colleges have a separate system. FCLA has extensively modified what was the NOTIS library system to build and manage the system locally instead of tying vendor systems together. To serve participant needs, FCLA has added additional services beyond the original mandate (e.g., indexes, gateway services), most funded by direct service fees.

Services: FCLA provides core library management services including online public access catalogs, acquisitions, circulation and coordinated use of OCLC for cataloging and interlibrary loan to participating libraries. In addition it offers a set of communications services and equipment. Optional library services include access to OCLC FirstSearch, gateways to Britannica, UnCover and other remote databases. FCLA provides a web site as a single point of patron access to all of these and related participant library services. FCLA provides buying cooperative services for databases although members also subscribe directly to some non-FCLA databases.

Organization and Governance: FCLA is an independent consortium of Florida's public 4-year colleges and universities, governed by an advisory board composed of one representative from each of the ten universities plus one representative from the Board of Regents, one representative from the Division of Community Colleges, and the state librarian. The Director of FCLA reports to the University of Florida Vice President for Academic Affairs, and all purchasing, payroll, and personnel functions are managed through the University of Florida.

Funding: FCLA core library management services are funded by a central budget appropriated by the state legislature. This funding only supports services, not database content, so FCLA does not represent a "virtual library."

FCLA is 100% state-funded. It has a $7.5 million operating budget that goes to salaries and benefits of its 26 staff, expenses, data processing, and equipment such as computers and other technical hardware. The libraries pay an additional $600,000 in pro-rated database licensing fees, with $300,000 paying for Research Library Group membership and services. The legislature is, however, considering assuming the licensing fees as well. FCLA is not a membership organization, so the libraries do not pay membership fees.

FCLA serves 135,000 FTE student end-users and 10,000 FTE faculty end-users. Staff FTE information is not available.

Member libraries pay access fees from their book budgets for optional database and gateway services and not all libraries subscribe to all services, so students at member institutions have access to different databases.

Membership: FCLA has no formal membership structure. Access to FCLA online library catalogs is available to all state residents. Use of other library functions, such as circulation and acquisitions, is restricted to participating libraries plus two community colleges that had programs with the university system libraries in place at the time FCLA was created.

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Georgia Library Learning Online (Galileo)

Overview: Galileo is building a "single statewide library" based upon a recently upgraded PeachNet--Georgia's telecommunications network for education. GALILEO plans to provide shared databases, universal borrowing, and unlimited access to the state's entire population, not only those enrolled in educational institutions, although the current implementation of licensed databases is limited to educational institutions. The state's public universities formed the initial GALILEO clients but K-12 and public library systems have recently joined the system. As part of the state library, GALILEO will electronically publish all of Georgia's state publications and census data.

Services: The GALILEO project aims to create a single statewide library by providing the services needed to achieve eight objectives (excerpted from "A Vision for One Statewide Library: GALILEO" Provide PeachNet (Internet) access to all University System and off-campus center libraries

- **Provide the electronic full-text of core academic journals;**
- **Facilitate sharing of research journals.**
- **Convert all of the University System card catalogs to computer format.**
- **Provide automation for each System library**
- **Support universal borrowing.**
- **Provide electronic access to state census data.**
- **Distribute state publications electronically.**

Several of these goals required initial one-time services:

- **Participating libraries are connected to the network and most received upgraded connections;**
- **Conversion of the card catalogs are completed via contract with OCLC;**
- **Libraries without full automation worked with GALILEO staff to adopt library automation systems;**

The goals of shared access to index and full text databases (including state publications and census data) are met with an existing set of services mounted at Georgia university systems and available via contract from vendors such as OCLC and Current Contents. GALILEO is using paper methods to facilitate universal access while investigating the feasibility of a universal patron file for Georgia.

Organization and Governance: GALILEO is staffed and governed by the Georgia University System; a steering committee manages operations and an advisory council provides strategic directions.

Funding: GALILEO is entirely state-funded, including the original organization to serve the state university system and the recent addition of K-12 and public libraries.

Membership: Participants include 34 University System institutions and 7 off-campus centers; 33 technical institutes and the headquarters offices; 57 public library systems and public library headquarters; and 37 private colleges and universities, joined recently by a large set of K-12 schools and public libraries.

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New York Comprehensive Research Libraries (NYCRL)

Overview: NYCRL aims to develop a digital library with equitable access to information from any (New York) place at any time. The initial project around which the consortium is organized is digitizing resources specifically related to New York's history, economy and culture.

Services: The 18-month "Making of New York" planning grant enables participants to design the process for cooperative digitization of materials of interest to New Yorkers. The 11 participants are also pursuing joint licensing agreements, selecting software applications for managing and presenting multimedia files to be used both within and across libraries, and developing an archiving system that can manage images and present them for easy use through the web.

NYCRL is in the very early phases of their initial project, which they hope will serve as a starting place for broader collaboration in the future.

Organization and Governance: NYCRL is a collaborative consortium of 11 public and private university libraries.

Funding: The Mellon Foundation recently awarded a planning grant to advance the project "The Making of New York: Past, Present and Future." For the long term, NYCRL is pursuing state, foundation and private funding. NYCRL expects funding will materialize to the extent that this project will tie digital library collections to real life applications.

The Mellon planning grant of $50,000 is NYCRL's only source of funds. They are pursuing state funding, but the member institutions are all private.

Since their efforts to date have been concentrated on the Mellon project on the history of New York, their end-users will include anyone in the state who will access the information online. Their biggest struggle, apart from funding, in developing a more substantial consortium has been figuring out collaborative protocol on collections issues.

Membership: Eleven public and private New York university libraries.

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University of California System

Overview: University of California libraries have a long history of collaboration. A result of two years of intensive planning across campuses, the recently announced California Digital Library will coordinate electronic-archiving projects on the system's nine campuses and will create a central database of electronic materials accessible from researchers' own computers. The initial focus will be on building a collection of materials related to science, technology, and industry. Some materials will only be available to University of California patrons. This profile will focus on the new California Digital Library initiative.

A long-term goal (10-year horizon) is a statewide virtual library. The University System is taking a lead role in exploring the prospects. A demonstration project is planned for early 1998 with public libraries. Access will be differentiated across state organizations based upon costs, needs and ability to pay. Long term, even different campuses within the System would have access to different sources. For example, UC San Francisco specializes in the health sciences, so it would need access to different information than a liberal arts college.

Services: The University of California System already provides extensive cooperative library services across the system including a union catalog, access to databases, full text content, professional training, and many more, coordinated through the System's central Division of Library Automation. The new initiative will build on past efforts to catalog and coordinate access to extensive electronic research materials created by UC system researchers.

Organization and Governance: Collaborative consortium of the libraries in California's University System staffed and coordinated by the Division of Library Automation in the UC Office of the President.

Funding: The new initiative will be launched with UC System and state funding, with campus support and funding from any other participating libraries. The University system is spending $1 million this year to start the library and wants $3 million next year to support it.

Membership: This is a California University System project. Outside libraries must provide support if they want to participate. Considering statewide virtual library within next ten years.

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The Virtual Library of Virginia (VIVA)

Overview: VIVA is in its second biennium as a collaborative consortium dedicated to serving Virginia's public libraries of higher education.

Services: Most VIVA effort is focused on collective purchase of electronic databases such as FirstSearch from OCLC and software or services such as the ARIEL document distribution software from the Research Libraries Group. Participant cooperation including modest operational cooperation such as funding clerical staff in major lending institutions to improve interlibrary loan services and developing communications scripts to facilitate access to VIVA vendors from smaller institutions.

Future plans include adding more shared databases, particularly full text collections and consideration of cooperative digitizing projects, particularly for special collections such as the history of Virginia.

Organization and Governance: Historically, VIVA has been largely volunteer and decentralized; 1997 is the first year with a full-time VIVA project director, and there is no centralized project or systems staff. This organization is deliberately chosen to avoid creating a bureaucratic organization. All production services rely upon external vendors.

The VIVA steering committee includes major doctoral institutions and representatives from four-year, community colleges, and private institutions. A set of advisory committees guides specific service collaborations.

Membership: VIVA was organized to support Virginia's public institutions of higher education (private institutions may join) and now includes 52 members from community colleges through doctoral institutions.

Funding: Public institution participation is funded by the state legislature, while private institutions must pay their costs.

VIVA's budget is 100% state-funded by money taken off of the top of allocations for public university libraries. The operating budget was $5 million for the biennium. VIVA is staffed with 1.5 FTE (.5 is technical support), but these salaries and benefits do not come out of the project budget—the project only pays half of their salaries and none of their benefits. $3.6 million for collections, with $200,000 going to special collections for digitization. They have appointed JMU to be responsible for procurement, and the schools have pooled $25,000 to pay the procurement officer for half of his time. At each of the six doctoral institutions, the project funds a clerk to aid interlibrary loan. Some of the budget goes to reimburse schools for interlibrary lending for Fed-Ex costs, and a very small amount goes toward workstation hardware (2 per school).

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